Workshop Manual
Audi A8 1994 ➢

TDI injection and glow plug system (8-cyl. Common Rail)									
Engine ID	AKF								

Edition 01.2005

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Repair Group

01 - Self-diagnosis

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Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.

Contents

01 – Self-diagnosis

1 Technical data of self-diagnosis

1.1 Features

Engine management for the V8-TDI (common rail) is handled by two engine control units.

The two engine control units communicate via a separate CAN bus.

The diesel direct injection system control unit -J248- informs diesel direct injection system control unit 2 -J494- of the functions to be performed.

The term “self-diagnosis” relates to the electrical/electronic section of the control system.

The two engine control units are provided with a fault memory to permit rapid determination of the cause of the problem in the event of failure of an electrical/electronic component or an open circuit in the wiring.

Full use can only be made of the options offered by self-diagnosis using the vehicle diagnostic, testing and information system -VAS 5051- or the fault reader -V.A.G 1551- in mode 1 “Rapid data transfer.”

For functions which can be registered by the vehicle diagnostic, testing and information system -VAS 5051- or the fault reader -V.A.G 1551- , refer to ⇒ page 1 , List of available functions.

The two fault memories are non-volatile memories and thus independent of the power supply.

1.2 Functions available under address word 01 or address word 11, engine electronics

Note

The prerequisites for selecting the desired functions can be taken from the following table.

Address words and functions on fault reader		Ignition on, engine not running	Idling	Vehicle in operation
Address words				
00	Automatic test sequence	yes	yes	yes
01	Engine electronics (diesel direct injection system control unit -J248-)	yes	yes	yes
11	Engine electronics 2 (diesel direct injection system control unit 2 -J494-)	yes	yes	yes
Functions				
01	Interrogating control unit version	yes	yes	yes
02	Interrogating fault memory	yes	yes	yes
03	Final control diagnosis	yes	no	no
04	Basic setting	no	yes	yes
05	Erasing fault memory	yes	yes	yes

Address words and functions on fault reader		Ignition on, engine not running	Idling	Vehicle in operation
06	End of output	yes	yes	yes
07	Encoding control unit	yes	no	no
08	Reading measured value block	yes	yes	yes

1.3 Connecting fault reader and selecting engine electronics control units

Test conditions

- Fuses OK
- Battery voltage at least 11.5 V
- Switch off air conditioner
- On vehicles with automatic gearbox, selector lever set to “P” or “N”

– Connect fault reader.

WARNING

- *When performing measurement and test drives, always attach the fault reader to the rear seat and have it operated from there by a second person.*
- *If measuring instruments and testers were to be operated from the front passenger's seat, the person sitting there could be seriously injured by triggering of the front passenger's airbag in the event of an accident.*

Depending on the function required:

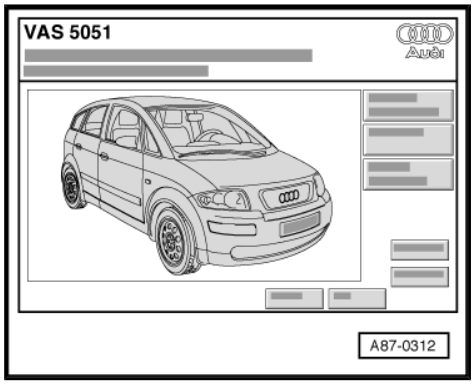
– Switch on ignition.

Or

Start engine ⇒ page 1 , “Available functions” table.

Selecting operating mode:

– Select “Vehicle self-diagnosis” function on fault reader.



Selecting vehicle system:

To select diesel direct injection system control unit -J248-

– Select “01 - Engine electronics” on display.

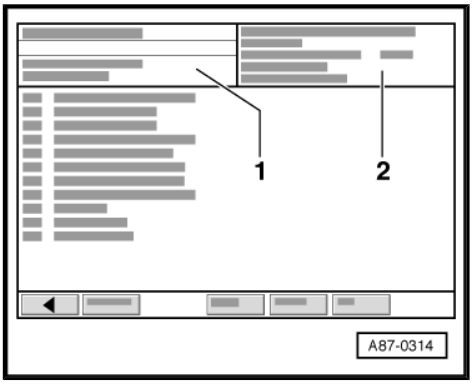
or

To select diesel direct injection system control unit 2 -J494-

– Select “11 - Engine electronics 2” on display.

Wait until “Select diagnosis function” appears in zone -1- on display of -VAS 5051- .

The control unit identification and encoding appear in display zone -2-, e.g.:



♦ 4D0 907 409..	Control unit number (refer also to Parts List)
♦ 3.3l	Engine capacity
♦ 4VT	4-valve
♦ EDC	Electronic Diesel Control
♦ G or no display	Vehicle with or without cruise control
♦ AG	Automatic gearbox
♦ D00	Data level (software version) of control unit
♦ Code 00016	Encoding of engine control unit 1
♦ WSC 12345	Workshop code from -V.A.G 1551- with which encoding was last performed

If the encoding does not correspond to the equipment in the vehicle:

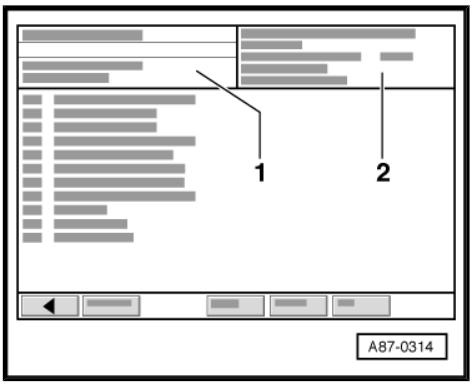
– Check control unit code ⇒ page 27 , encoding engine control unit.

Selecting diagnosis function:

At this point all diagnosis functions are available.

– Select desired function on display.

– Refer to repair operations for further procedure.



Note

- *In functions 04 - Basic setting and 08 - Reading measured value block, the display zones are shown from top to bottom.*
- *If the displays shown in the work sequence do not appear, refer to ⇒ Operating instructions for vehicle diagnostic, testing and information system VAS 5051.*

1.4 Interrogating and erasing fault memory

On fault memory interrogation, the diesel direct injection system control unit -J248- and diesel direct injection system control unit 2 -J494- are always to be consecutively interrogated and erased.

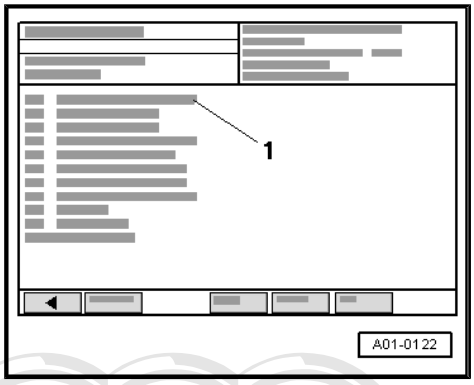
– Connect up the fault reader and touch the vehicle system in the list. When doing so, the engine should be idling.

Note

If the engine does not start, crank it with the starter for at least 5 seconds and then always leave the ignition switched on.

Display:

– From list -1-, select diagnosis function “02 - Interrogating fault memory”.



Display:

1 - Content of fault memory:

r - 0 faults detected

- Or

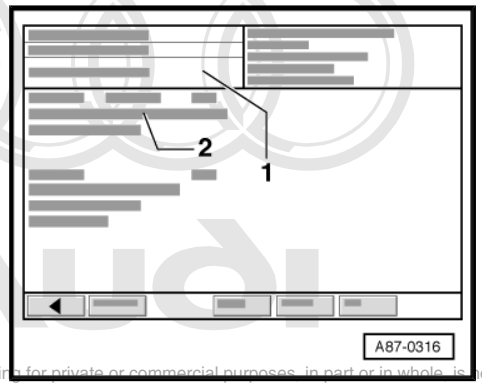
r - X faults detected

2 - Fault

r - Fault code

r - Fault location

r - Type of fault



A - Faults detected:

– Print out information on screen or self-diagnosis log.

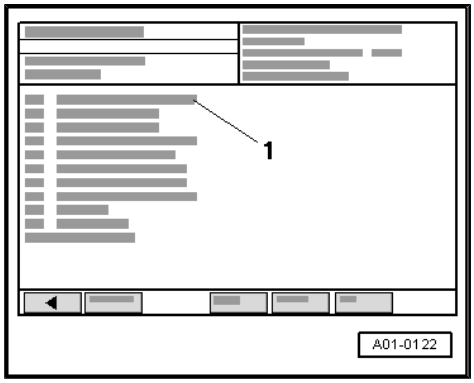
– Terminate function “02 - Interrogating fault memory” by touching ▾ key.

Display:

– Eliminate fault(s) in line with fault table.

– Select diagnosis function “02 - Interrogating fault memory” again in list and erase fault memory.

– Select diagnosis function “06 - End output” in list.



B - No fault detected:

– Select diagnosis function “06 - End output” in list.

Erasing fault memory

Note

If fault memory cannot be erased, interrogate fault memory again and eliminate fault.

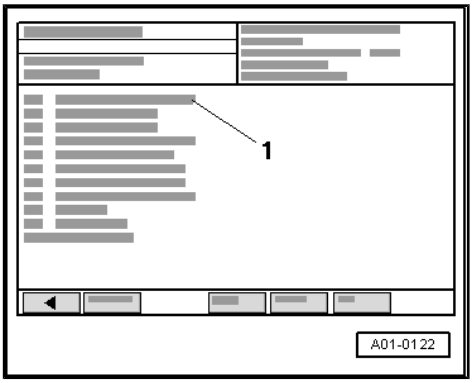
Note

- *Fault memory interrogated*
- *All faults eliminated*

After fault memory interrogation:

Display:

– From list -1-, select diagnosis function “05 - Erasing fault memory”.

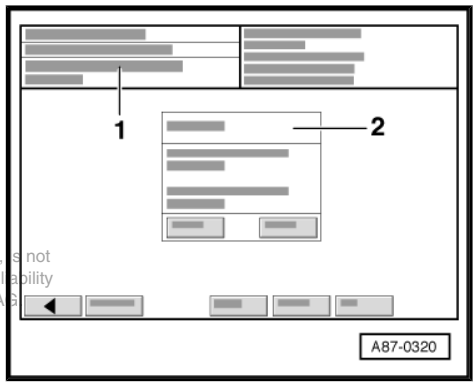


Display:

1 - No display (prior to erasing)

- Or

r - Fault memory erased



Note

If the following message appears in display zone -1-: “Fault memory not yet interrogated”, this indicates failure to comply exactly with the correct procedure. The fault memory can only be erased after it has been interrogated.

2 - Note: Is function to be implemented? Note: Data will be erased!

– Touch OK key in display -2-.

– Terminate function “05 - Erasing fault memory” by touching ▾ key.

– Interrogate fault memory again on completion of repair work and erase it if applicable.

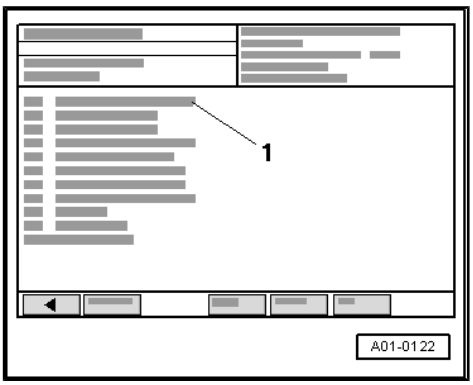
Note

This erases faults stored during fault rectification, e.g. as a result of unplugging connectors.

End of output

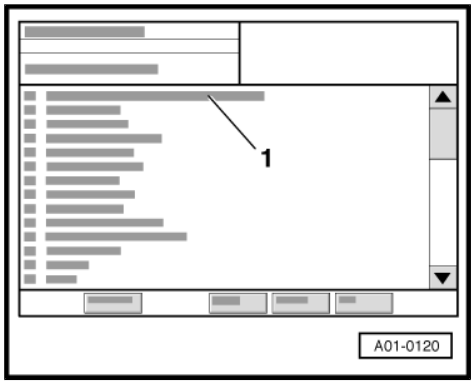
Display:

– From list -1-, select diagnosis function “06 - End of output”.



Display:

– Switch off ignition and unplug diagnostic connector when this display appears.



1.5 Fault table

Note

- *Faults occurring in monitored sensors or components are stored in the fault memory of engine control unit 1 or 2 together with an indication of the type of fault.*
- *The fault table is arranged according to the 5-digit fault codes in the left-hand column.*
- *Sporadic faults (temporary faults) are marked "SP" on the display.*
- *If a stored fault does not reoccur within the next 40 engine starts, the fault code is erased automatically.*
- *The components shown to be defective by the fault reader are not to be replaced immediately. Start by using the current flow diagram to check the wiring and connectors to these components. The earth connections are also to be checked on the basis of the current flow diagram. This is particularly important in the case of "sporadic" faults, marked SP.*

Fault code		Fault text	Remedy
SAE	V.A.G		
P0101	16485	Air mass meter -G70- Implausible signal	Check battery Air cleaner clogged Perform basic setting (display groups 03 and 33) ⇒ page 22 Check air mass meter -G70- ⇒ page 110
P0116	16500	Coolant temperature sender -G62- Implausible signal	Check coolant temperature sender -G62- ⇒ page 104

Fault code		Fault text	Remedy
SAE	V.A.G		

Fault code		Fault text	Remedy
P0192	16576	Fuel pressure sender -G247- Short to earth	Check fuel pressure sender -G247- ⇒ page 107
P0197	16581	Oil temperature sender -G8- Signal too low	Check oil temperature sender -G8- ⇒ page 106
P0198	16582	Oil temperature sender -G8- Signal too high	
P0321	16705	Engine speed sender -G28- Implausible signal	Check engine speed sender -G28- ⇒ page 103
P0322	16706	Engine speed sender -G28- No signal	
P0335	16719	Engine speed sender -G28- Malfunction	

Fault code		Fault text	Remedy
SAE	V.A.G		
P0340	16724	Camshaft position sensor Malfunction	Check Hall sender -G40- ⇒ page 118
P0380	16764	Glow plug -Q6- Electrical fault in circuit	Check glow plugs ⇒ page 131
P0501	16885	Vehicle speed signal Implausible signal	Check vehicle speed signal ⇒ page 123 or . ⇒ Electrical system; Rep. Gr. 90; Gauges, instruments
P0503	16887	Vehicle speed signal Signal too high	

Fault code		Fault text	Remedy
SAE	V.A.G		
P0562	16946	Voltage supply Voltage too low	Check battery voltage Check engine control unit 1 power supply ⇒ page 98
P0563	16947	Voltage supply Voltage too high	
P0571	16955	Brake light switch -F- Implausible signal	Check brake light Check fuse Check brake light switch -F- and brake pedal switch -F47- ⇒ page 120
P0601	16985	Control unit defective [1)]	Replace engine control unit 1 ⇒ page 69 or Replace engine control unit 2 ⇒ page 74
P0603	16987	Control unit defective [1)]	
P0604	16988	Control unit defective [1)]	
P0605	16989	Control unit defective [1)]	
P0606	16990	Control unit defective [1)]	

1) If one of these faults is displayed in the fault memory of engine control unit 1, replace engine control unit 1. If one of these faults is displayed in the fault memory of engine control unit 2, replace engine control unit 2.

Fault code		Fault text	Remedy
SAE	V.A.G		
P1020	17428	Fuel pressure regulation Control limit exceeded	Check fuel pressure sender -G247- ⇒ page 107 Check fuel pressure regulating valve -N276- ⇒ page 108 Check fuel metering valve -N290- ⇒ page 109

Fault code		Fault text	Remedy
SAE	V.A.G		
P1025	17433	Fuel pressure regulating valve -N276- Mechanical fault	Air in fuel system, visible at supply pipe Check high-pressure section for leaks
P1063	17471	Fuel pressure regulation Control limit not reached	Fuel pressure too low, check pre-supply pressure ⇒ page 97 Check fuel filter for fuel; if not OK, then check:
P1064	17472	Fuel pressure system Mechanical fault	Suction jet pump in fuel tank and fuel bypass valve -N312- ⇒ Rep. Gr. 20
P1065	17473	Fuel pressure regulation Control difference	Check fuel pressure regulating valve -N276- ⇒ page 108 Check operation of injectors ⇒ page 80 Fuel metering valve -N290- mechanical fault Fuel pressure regulating valve -N276 mechanical fault High-pressure pump defective

Note

The fault codes V.A.G 17471 and 17473 may also be stored if the tank has been inadvertently run empty.

Fault code		Fault text	Remedy
SAE	V.A.G		
P1144	17552	Air mass meter -G70- Open circuit/Short to earth	Cable break at connector (cable tie attached too tightly) Check air mass meter -G70- ⇒ page 111
P1145	17553	Air mass meter -G70- Short to positive	
P1146	17554	Air mass meter -G70- Supply voltage	
P1155	17563	Sensor for intake manifold pressure -G71- Short to positive	Check intake manifold pressure sender -G71- ⇒ Rep. Gr. 21 .
P1156	17564	Sensor for intake manifold pressure -G71- Open circuit/Short to earth	
P1157	17565	Sensor for intake manifold pressure -G71- Supply voltage	

Fault code		Fault text	Remedy
P1158	17566	Sensor for intake manifold pressure -G71- Implausible signal	

Fault code		Fault text	Remedy
SAE	V.A.G		
P1159	17567	Air mass meter 1 / air mass meter 2 signal Implausible ratio	Air cleaner clogged, air intake duct contaminated ⇒ page 66 . Engine control unit data level at least D05 (data level D05 is only intended for enhanced diagnosis of vehicle system). In basic setting, check actuation of exhaust gas recirculation valves in display group 03 and turbochargers in display group 33 ⇒ Refer to notes on consecutive work process.

Note

- *If fault code 17964 or a fault code relating to exhaust gas recirculation has been stored in conjunction with fault code 17567, fault code 17567 may be a resultant fault. Start by eliminating the other fault codes and then check (erase fault memory and perform test drive) whether fault code 17567 has been stored again in the fault memory.*
- *Prior to testing, always start by checking for contamination of the air intake duct between the air cleaner and the turbochargers ⇒ page 66 .*
- *Refer to next page for further important notes.*

Note

- *Incorrect actuation of the vacuum for the exhaust gas recirculation valve and the turbochargers will result in differences in turbocharger delivery or differing exhaust gas recirculation rates.*
- *Use a T-piece to connect up two vacuum gauges between the vacuum hoses to the exhaust gas recirculation valves. Connect up the vehicle diagnostic, testing and information system -VAS 5051- . Start engine and select measured value block 03 in function "Basic setting 04". The vacuum reading must be approximately equal on both gauges. If not, check entire vacuum supply system for exhaust gas recirculation valves ⇒ page 53 . If vacuum supply is OK, replace exhaust gas recirculation valves -N18- and -N213- ⇒ Rep. Gr. 26 .*
- *Differing exhaust gas recirculation rates can also be caused by a sticking EGR valve.*
- *Different turbocharger settings may cause the delivery rate of the turbochargers to fluctuate.*
- *Use a T-piece to connect up two vacuum gauges between the vacuum hoses of the two vacuum units for charge pressure control. Connect up the vehicle diagnostic, testing and information system -VAS 5051- . Start engine and select measured value block 33 in function "Basic setting 04". The vacuum readings are 600 - 630 mbar with the turbocharger vanes in closed position and 200 - 230 mbar with the turbocharger vanes in open position. Also perform visual inspection to check whether linkage of turbochargers is functioning properly. If the linkage is sticking, replace both turbochargers. If the specified values are not attained or if they are exceeded, check the entire vacuum tubing system ⇒ page 52 . If this is OK, replace charge pressure control solenoid valve -N75- and charge pressure control solenoid valve 2 -N274- ⇒ Rep. Gr. 21 .*

Checking exhaust gas recirculation valves

- Start engine, initiate "Basic setting 04" and select measured value block 03.
- For specifications, refer to Basic setting section ⇒ page 22 .

If display shows exhaust gas recirculation not active (display zone 2)			
↓		↓	
Air flow actual values not OK		Air flow actual values OK	
↓		↓	
Mechanically seal off exhaust gas recirculation valves, e.g. with metal strips		Check actual values with exhaust gas recirculation active	
↓	↓	↓	↓
If actual values are now attained	If actual values are still not attained	If actual values are not attained	If actual values are attained
↓	↓	↓	↓
Replace both exhaust gas recirculation valves	Check charge pressure control (measured value block 33)	Replace both exhaust gas recirculation valves	Check charge pressure control (measured value block 33)

Checking charge pressure control

- Select measured value block 33 in "Basic setting 04".
- For specifications, refer to Basic setting section ⇒ page 22 .

Charge air control	
↓ If the two air flow actual values for one turbocharger side are below the specifications, both air mass meters must be replaced. At the same time, the air flow actual values for the other turbocharger side must not deviate significantly from the specifications. ↓ If replacing the air mass meters does not eliminate the fault, this may be an indication of a double fault. Continue fault-finding in the charge pressure control system.	↓ If at least one actual value deviates from the specification, replace both turbochargers. The corresponding value for the other turbocharger side is influenced by the defective turbocharger. ↓ Following replacement of the turbochargers, the two air mass meters must also be replaced. ↓ If replacement of the turbochargers and the air mass meters does not bring any improvement, the front pipes may be clogged (catalytic converter damage).

Fault code		Fault text	Remedy
SAE	V.A.G		
P1160	17568	Sensor for manifold temp. -G72- 2) Short to earth	Check intake air temperature sender -G42- ⇒ page 105
P1161	17569	Sensor for manifold temp. -G72- 2) Open circuit/Short to positive	
P1162	17570	Sensor for fuel temp. -G81- Short to earth	Fuel temperature sender -G81- Check ⇒ page 106
P1163	17571	Sensor for fuel temp. -G81- Open circuit/Short to positive	
P1164	17572	Sensor for fuel temp. -G81- Implausible signal	

2) In the event of fault codes 17568 and 17569, intake manifold temperature sender -G72- , check the intake air temperature sender -G42- (joint component with air mass meter -G70-).

Fault code		Fault text	Remedy
SAE	V.A.G		
P1167	17575	Air mass meter 2 -G246- Implausible signal	Perform basic setting, display groups 03 and 33 ⇒ page 22 Check air mass meter 2 -G246- ⇒ page 110
P1168	17576	Air mass meter 2 -G246- Open circuit/Short to earth	Cable break at connector (cable tie attached too tightly) Check air mass meter 2 -G246- ⇒ page 113
P1169	17577	Air mass meter 2 -G246- Short to positive	
P1170	17578	Air mass meter 2 -G246- Supply voltage	

Fault code		Fault text	Remedy
SAE	V.A.G		
P1192	17600	Fuel pressure sender -G247- Supply voltage	Fuel pressure sender -G247- Check ⇒ page 107
P1193	17601	Fuel pressure sender -G247- Open circuit/Short to positive	

Fault code		Fault text	Remedy
P1194	17602	Fuel pressure regulating valve -N276- Short to positive	Fuel pressure regulating valve -N276- Check ⇒ page 108
P1195	17603	Fuel pressure regulating valve -N276- Open circuit/Short to earth	

Fault code		Fault text	Remedy
SAE	V.A.G		
P1201	17609	Injector Cyl. 1 -N30- Electrical fault in current circuit	Check injectors ⇒ page 77
P1202	17610	Injector Cyl. 2 -N31- Electrical fault in current circuit	
P1203	17611	Injector Cyl. 3 -N32- Electrical fault in current circuit	
P1204	17612	Injector Cyl. 4 -N33- Electrical fault in current circuit	
P1205	17613	Injector Cyl. 5 -N83- Electrical fault in current circuit	
P1206	17614	Injector Cyl. 6 -N84- Electrical fault in current circuit	
P1207	17615	Injector Cyl. 7 -N85- Electrical fault in current circuit	
P1208	17616	Injector Cyl. 8 -N86- Electrical fault in current circuit	

Fault code		Fault text	Remedy
SAE	V.A.G		
P1237	17645	Injector Cyl. 1 -N30- Open circuit	Check injectors ⇒ page 77 – Unplug connector at corresponding injector and check pins for corrosion and firm attachment.
P1238	17646	Injector Cyl. 2 -N31- Open circuit	
P1239	17647	Injector Cyl. 3 -N32- Open circuit	
P1240	17648	Injector Cyl. 4 -N33- Open circuit	
P1241	17649	Injector Cyl. 5 -N83- Open circuit	
P1242	17650	Injector Cyl. 6 -N84- Open circuit	
P1243	17651	Injector Cyl. 7 -N85- Open circuit	
P1244	17652	Injector Cyl. 8 -N86- Open circuit	

Fault code		Fault text	Remedy
SAE	V.A.G		
P1255	17663	Sensor for coolant temp. -G62- Short to earth	Check coolant temperature sender -G62- ⇒ page 104
P1256	17664	Sensor for coolant temp. -G62- Open circuit/Short to positive	

Fault code		Fault text	Remedy
P1278	17686	Fuel metering valve -N290- Short to positive	Check fuel metering valve -N290- ⇒ page 109
P1279	17687	Fuel metering valve -N290- Open circuit/Short to earth	
P1299	17707	Fuel metering valve -N290- Malfunction	Check fuel metering valve -N290- ⇒ page 109 Engine control unit 1 data level at least D04 Engine control unit 2 data level at least D03

Note

The high-pressure pump performs a self-test after starting the engine. In the event of powerful acceleration at this point, the engine control unit may detect: Rail pressure not being dissipated quickly enough. Fault code 17707 is then stored in the engine control unit.

Fault code		Fault text	Remedy
SAE	V.A.G		
P1387	17795	Control unit defective	Replace diesel direct injection system control unit -J248- (without protective housing) ⇒ page 69 Replace diesel direct injection system control unit -J248- (with protective housing) ⇒ page 70
P1389	17797	Diesel direct injection system control unit 2 -J494- Defective	Replace diesel direct injection system control unit 2 -J494- ⇒ page 74
P1397	17805	Engine speed sender wheel Adaption limit reached	Check oil level

Fault code		Fault text	Remedy
SAE	V.A.G		
P1402	17810	Valve for exhaust gas recirculation -N18- Short to positive	Check exhaust gas recirculation valve -N18- ⇒ Rep. Gr. 26
P1403	17811	Exhaust gas recirculation system Control difference	Perform basic setting, display groups 03 and 33 ⇒ page 22
P1437	17845	Exhaust gas recirculation valve 2 -N213- Short to positive	Check exhaust gas recirculation valve -N18- and exhaust gas recirculation valve 2 -N213- ⇒ Rep. Gr. 26
P1438	17846	Exhaust gas recirculation valve 2 -N213- Open circuit/Short to earth	
P1441	17849	EGR valve -N18- Open circuit/Short to earth	

Fault code		Fault text	Remedy
SAE	V.A.G		

Fault code		Fault text	Remedy
P1502	17910	Fuel pump relay -J17- Short to positive	Check fuel pump relay -J17- ⇒ Rep. Gr. 20
P1503	17911	Load signal from alternator term. DF Implausible signal	Eliminate open circuit in wiring or short circuit. ⇒ Current flow diagrams, Electrical fault-finding and Fitting locations
P1523	17931	Crash signal from airbag CU Implausible signal	Check crash signal ⇒ page 121
P1524	17932	Fuel pump relay -J17- Open circuit/Short to earth	Check fuel pump relay -J17- ⇒ Rep. Gr. 20

Fault code		Fault text	Remedy
SAE	V.A.G		
P1540	17948	Vehicle speed signal Signal too high	Check vehicle speed signal ⇒ page 123
P1546	17954	Charge press. control solenoid valve -N75- Short to positive	Check charge pressure control solenoid valve -N75- ⇒ Rep. Gr. 21
P1549	17957	Charge press. control solenoid valve -N75- Open circuit/Short to earth	

Fault code		Fault text	Remedy
SAE	V.A.G		
P1556	17964	Charge pressure control Regulating limit not reached	Check angular sections and vacuum tubing of charge pressure control system ⇒ page 52 Perform basic setting, display groups 03 and 33 ⇒ page 22
P1557	17965	Charge pressure control Regulating limit surpassed	

Note

- *Intermittent leakage and sporadic fault entries may occur depending on the location and position of the vacuum pipes.*
- *Check connecting piece between vacuum pipe and vacuum reservoir in wheel housing. If connecting piece has broken off or if it is cracked, turn vacuum reservoir through 180 degrees so that connection is facing downwards. Fit a new approx. 730 mm long vacuum hose, taking care to avoid strain.*

Fault code		Fault text	Remedy
SAE	V.A.G		
P1569	17977	Cruise control system switch -E45- Implausible signal	Check cruise control system switch -E45- ⇒ Electrical system; Rep. Gr. 01
P1570	17978	Engine control unit Blocked	Adapt immobilizer to engine control unit ⇒ Electrical system; Rep. Gr. 01

Fault code		Fault text	Remedy
SAE	V.A.G		
P1586	17994	Engine mounting solenoid valves -N144- / -N145- Short to positive	Eliminate open circuit in wiring or short circuit. ⇒ Current flow diagrams, Electrical fault-finding and Fitting locations
P1600	18008	Voltage supply term. 15 Voltage too low	Engine control unit 1 ⇒ page 98 or engine control unit 2 power supply ⇒ page 102
P1601	18009	Terminal 30 voltage supply relay -J317- 3) Implausible signal	

3) If this fault is displayed in the fault memory of engine control unit 1, check engine control unit 1 power supply. If this fault is displayed in the fault memory of engine control unit 2, check engine control unit 2 power supply.

Fault code		Fault text	Remedy
SAE	V.A.G		
P1604	18012	Control unit defective 4)	Check for contact resistance (short to earth) in wiring/check plug contacts between corresponding engine control unit and injectors ⇒ page 77 . If no contact resistance is found, replace engine control unit 1 or engine control unit 2 ⇒ page 74
P1609	18017	Crash deactivation triggered	Accident involving airbag triggering or Final control diagnosis performed in airbag control unit, thus resulting in fault entry in engine control unit (erase fault memory)
P1610	18018	Control unit defective 4)	Replace engine control unit 1 ⇒ page 69 or replace engine control unit 2 ⇒ page 74

4) If one of these faults is displayed in the fault memory of engine control unit 1, replace engine control unit 1. If one of these faults is displayed in the fault memory of engine control unit 2, replace engine control unit 2.

Fault code		Fault text	Remedy
SAE	V.A.G		
P1612	18020	Engine control unit wrongly coded 5)	Encode engine control unit 1 or 2 ⇒ page 27
P1618	18026	Glow plug relay -J52- Short to positive	Check fuses Eliminate open circuit in wiring or short circuit
P1619	18027	Glow plug relay -J52- Open circuit/Short to earth	. ⇒ Current flow diagrams, Electrical fault-finding and Fitting locations
P1626	18034	Data bus drive No message from gearbox CU	Check CAN bus ⇒ page 121
P1631	18039	Accelerator position sender -G79- Signal too high	Check accelerator pedal position sender -G79-

Fault code		Fault text	Remedy
P1632	18040	Accelerator position sender -G79- Supply voltage	⇒ Rep. Gr. 20

5) If this fault is displayed in the fault memory of engine control unit 1, encode engine control unit 1. If this fault is displayed in the fault memory of engine control unit 2, encode engine control unit 2.

Fault code		Fault text	Remedy
SAE	V.A.G		
P1636	18044	Data bus drive No message from airbag CU	Check CAN bus ⇒ page 125
P1639	18047	Accelerator position sender 1/2 -G79+-G185 Implausible signal	Check accelerator pedal position sender -G79- and accelerator pedal position sender 2 -G185- ⇒ Rep. Gr. 20
P1640	18048	Control unit defective [6]	Replace engine control unit 1 ⇒ page 69 or replace engine control unit 2 ⇒ page 74
P1648	18056	Drive system data bus Defective	Check CAN bus ⇒ page 125

6) If this fault is displayed in the fault memory of engine control unit 1, replace engine control unit 1. If this fault is displayed in the fault memory of engine control unit 2, replace engine control unit 2.

Fault code		Fault text	Remedy
SAE	V.A.G		
P1649	18057	Drive system data bus No message from ABS control unit	Check CAN bus ⇒ page 125 or Check adaption for drive system data bus in dash panel insert ⇒ Electrical system; Rep. Gr. 01
P1650	18058	Drive system data bus No message from dash panel insert	
P1654	18062	Read out fault memory of dash panel insert	Interrogate fault memory of dash panel insert ⇒ Electrical system; Rep. Gr. 01
P1656	18064	Air conditioner input/output Short to earth	Interrogate air conditioner fault memory ⇒ Air conditioning; Rep. Gr. 01
P1657	18065	Air conditioner input/output Short to positive	

Fault code		Fault text	Remedy
SAE	V.A.G		
P1659	18067	Radiator fan actuation 1 Short to positive	Check radiator fan actuation 1 ⇒ Rep. Gr. 19
P1661	18069	Radiator fan actuation 2 Short to positive	
P1672	18080	Radiator fan actuation 1 Open circuit/short to earth	
P1682	18090	Drive system data bus Implausible message from ABS control unit	Read out fault memory of ABS control unit ⇒ Running gear, self-diagnosis for ABS, ESP; Rep. Gr. 01

Fault code		Fault text	Remedy
P1900	18308	Radiator fan actuation 2 Open circuit/short to earth	Check radiator fan actuation 2 ⇒ Rep. Gr. 19

Fault code		Fault text	Remedy
SAE	V.A.G		
P1901	18309	Radiator fan run-on control unit -J138- Short to positive	Check radiator fan run-on control unit -J138- Eliminate open circuit in wiring or short circuit
P1902	18310	Radiator fan run-on control unit -J138- Open circuit/Short to earth	⇒ Current flow diagrams, Electrical fault-finding and Fitting locations
P1903	18311	Radiator fan valve -N313- Short to positive	Check radiator fan valve -N313-
P1904	18312	Radiator fan valve -N313- Open circuit/Short to earth	⇒ Rep. Gr. 19
P1905	18313	Charge air cooling pump relay -J536- Short to positive	Check charge air cooling pump relay -J536-
P1906	18314	Charge air cooling pump relay -J536- Open circuit/Short to earth	⇒ Rep. Gr. 19

Fault code		Fault text	Remedy
SAE	V.A.G		
P1907	18315	Engine/engine data bus Defective	Check data exchange between engine control units 1 and 2 ⇒ page 126
P1908	18316	Engine/engine data bus Software version monitoring	Internal software version monitoring between the two engine control units Data level of both engine control units must coincide
P1909	18317	Engine/engine data bus No message from engine control unit 1	Fault is only stored in engine control unit 2 Engine control unit 2 not receiving message from engine control unit 1 ⇒ page 125
P1910	18318	Engine/engine data bus No message from engine control unit 2	Fault is only stored in engine control unit 1 Engine control unit 1 not receiving message from engine control unit 2 ⇒ page 125

Fault code		Fault text	Remedy
SAE	V.A.G		
P1911	18319	Engine/engine synchronisation wire Electr. fault in circuit	Check data exchange between engine control units 1 and 2 ⇒ page 125
P1920	18328	Engine mounting solenoid valves -N144- / -N145- Open circuit/Short to earth	Eliminate open circuit in wiring or short circuit. ⇒ Current flow diagrams, Electrical fault-finding and Fitting locations

Fault code		Fault text	Remedy
P1923	18331	Read out fault memory of engine control unit 2	Read out fault memory of engine control unit 2
P3008	19464	Camshaft position sensor -G40- Signal outside tolerance	Check Hall sender -G40- ⇒ page 118

Fault code		Fault text	Remedy
SAE	V.A.G		
P3009	19465	Fuel cooling pump relay -J445- Short to positive	Check fuel cooling pump relay -J445-
P3010	19466	Fuel cooling pump relay -J445- Open circuit/Short to earth	⇒ Rep. Gr. 19
P3011	19467	Electric fuel pump 2 relay -J49- Short to positive	Check electric fuel pump 2 relay -J49-
P3012	19468	Electric fuel pump 2 relay -J49- Open circuit/Short to earth	⇒ Rep. Gr. 20
P3013	19469	Charge pressure control solenoid valve 2 -N274- Short to positive	Check charge pressure control solenoid valve 2 -N274-
P3014	19470	Charge pressure control solenoid valve 2 -N274- Open circuit/Short to earth	⇒ Rep. Gr. 21

Fault code		Fault text	Remedy
SAE	V.A.G		
P3015	19471	Fuel bypass valve -N312- Short to positive	Eliminate open circuit in wiring or short circuit
P3016	19472	Fuel bypass valve -N312- Open circuit/Short to earth	⇒ Current flow diagrams, Electrical fault-finding and Fitting locations
P3104	19560	Variable intake manifold flap changeover valve -N239- Short to positive	Check variable intake manifold flap changeover valve -N239-
P3105	19561	Variable intake manifold flap changeover valve -N239- Open circuit/Short to earth	⇒ page 117

2 Final control diagnosis

Note

- *During final control diagnosis, the individual control elements are actuated (for max. 30 seconds) until the next control element is selected by pressing the → key.*
- *The control elements are checked acoustically or by way of touch.*
- *Final control diagnosis can only be repeated after starting the engine and then switching the ignition off and on again.*

The final control diagnosis actuates the following components in the stated sequence:

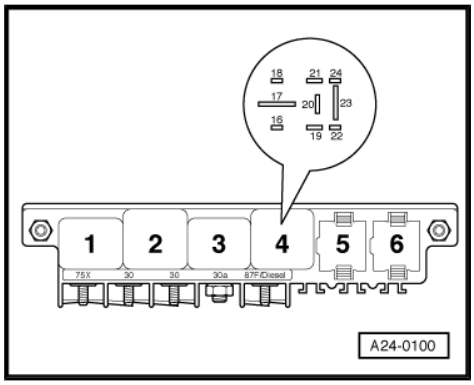
1. Glow plug relay -J52-
2. Radiator fan run-on control unit -J138- (fan runs at low speed)
3. Radiator fan actuation 1 (fan runs at medium speed)
4. Radiator fan actuation 2 (fan runs at high speed)
6. Fuel pump relay -J17-
7. Electric fuel pump 2 relay -J49-
8. Fuel cooling pump relay -J445-
5. Charge air cooling pump relay -J536-

– Connect fault reader and select control unit for engine electronics 1. When doing this, the ignition must be switched on.

– Press function “Final control diagnosis”.

Checking glow plug relay -J52-

Specification: Glow plug relay (relay and fuse carrier in electronics box in plenum chamber) must click.



Due to the high current input of the glow plugs, energisation and deenergisation of the relay can also be seen from the passenger compartment light becoming brighter and dimmer.

If the glow plug relay does not click:

– Check glow plug relays ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

Checking radiator fan run-on control unit -J138-

The radiator fan must start up at low speed every 5 seconds and then stop again.

Note

- *The radiator fan may also be actuated by the thermoswitch, automatic gearbox or air conditioner as a function of temperature. When performing final control diagnosis, make sure actuation does not take place for any of these reasons.*
- *Allow engine to cool down if necessary.*

If the radiator fan is not actuated:

– Check radiator fan actuation ⇒ Rep. Gr. 19 .

Checking radiator fan actuation 1

The radiator fan must start up at medium speed every 5 seconds and then stop again.

Note

- *The radiator fan may also be actuated by the thermoswitch, automatic gearbox or air conditioner as a function of temperature. When performing final control diagnosis, make sure actuation does not take place for any of these reasons.*
- *Allow engine to cool down if necessary.*

If the radiator fan is not actuated:

– Check radiator fan actuation ⇒ Rep. Gr. 19 .

Checking radiator fan actuation 2

The radiator fan must start up at high speed every 5 seconds and then stop again.

Note

- *The radiator fan may also be actuated by the thermoswitch, automatic gearbox or air conditioner as a function of temperature. When performing final control diagnosis, make sure actuation does not take place for any of these reasons.*
- *Allow engine to cool down if necessary.*

If the radiator fan is not actuated:

– Check radiator fan actuation ⇒ Rep. Gr. 19 .

Checking charge air cooling pump relay -J536-

The charge air cooling pump must start up every 5 seconds and then stop again (listen at front left bumper).

If the charge air cooling pump does not start up:

– Check charge air cooling pump relay actuation ⇒ Rep. Gr. 19 .

Checking fuel pump relay -J17-

The fuel pump must start up every 5 seconds and then stop again (listen in area of rear right wheel housing).

If the fuel pump is not actuated:

– Check fuel pump actuation ⇒ Rep. Gr. 20 .

Electric fuel pump 2 relay -J49-

Electric fuel pump 2 must start up every 5 seconds and then stop again (listen in area of rear right wheel housing).

If electric fuel pump 2 is not actuated:

– Check actuation of electric fuel pump 2 ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

Checking fuel cooling pump relay -J445-

The fuel cooling pump must start up every 5 seconds and then stop again (listen in front right bumper area).

If the fuel cooling pump is not actuated:

– Check actuation of fuel cooling pump relay -J445- ⇒ Rep. Gr. 19 .

Note

Final control diagnosis can only be repeated after starting the engine and then switching the ignition off and on again.

3 Basic setting

Test conditions:

- Coolant temperature at least 80 °C
- Do not press accelerator
- Electrical equipment switched off (radiator fan must not run during test)
- Air conditioner switched off
- Selector lever set to P or N

– Connect up fault reader and select vehicle system “01 - Engine electronics” from list. When doing this, the ignition must be switched on.

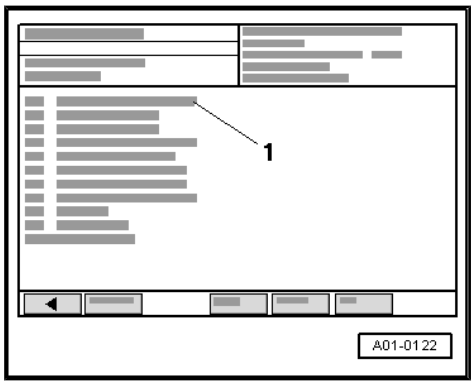
Or, depending on desired operation:

– Start engine.

– Interrogate and erase fault memory of both engine control units. There must not be any faults stored (if necessary, eliminate faults, erase fault memory, switch off and re-start engine, perform test drive and interrogate fault memories of both engine control units again as a check).

Display:

– From list -1- select diagnosis function “04 - Basic setting”.



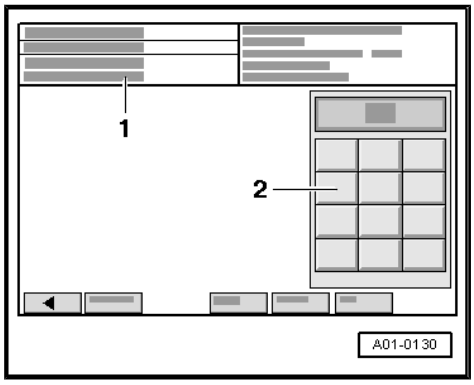
Display:

1 - Enter display group

– Use keypad -2- to enter desired display group number and confirm entry by touching Q key.

Example:

– Enter “001” for “display group number 001” and confirm by touching Q-key.



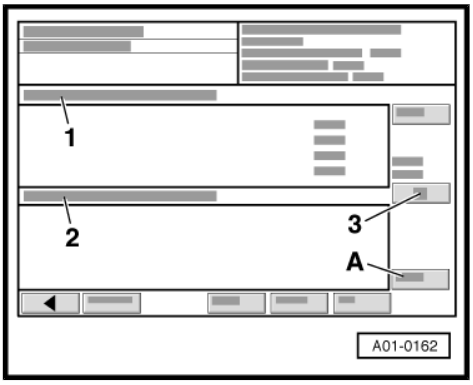
Display:

1 - Measured values not in basic setting

2 - Measured values in basic setting

3 - Display group X

A - Activate basic setting



Note

Basic setting is initiated after touching key -A-.

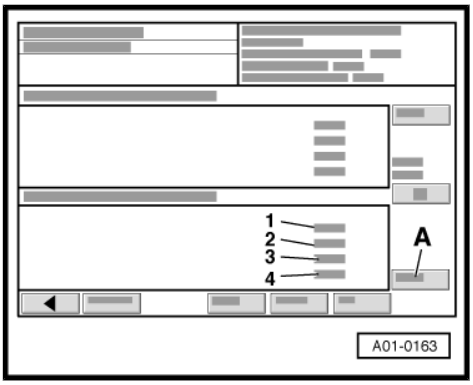
Display:

1 - Display zone 1

2 - Display zone 2

3 - Display zone 3

4 - Display zone 4



– Terminate function “04 - Basic setting” by touching ▾ key.

Display group 003 at idle (engine control units up to data level D04)

This display group is used for checking exhaust gas recirculation. The exhaust gas recirculation valve -N18- is alternately opened and closed for 10 seconds.

System in basic setting 3 →	▾ Indicated on display
1000 rpm EGR n. active 430 mg/S 100 %	
Duty cycle (actuation) of exhaust gas recirculation valve -N18-	
Air flow • 370 to 480 mg / stroke with EGR not active: OK	
Exhaust gas recirculation status • EGR not active	
Engine speed	

Note

- *Incorrect actuation of the vacuum for the exhaust gas recirculation valve results in different exhaust gas recirculation rates.*
- *Differing exhaust gas recirculation rates can also be caused by a sticking EGR valve ⇒ Rep. Gr. 26 .*

Display group 003 at idle (engine control units up to data level D04)

This display group is used for checking exhaust gas recirculation. The exhaust gas recirculation valve -N18- is alternately opened and closed for 10 seconds.

System in basic setting 3 →	▾ Indicated on display

1000 rpm	EGR active	180 mg/S	0 %	
				Duty cycle (actuation) of exhaust gas recirculation valve -N18-
				Air flow • 100 to 200 mg / stroke with EGR active: OK
				Exhaust gas recirculation status • EGR active
				Engine speed

Note

- *Incorrect actuation of the vacuum for the exhaust gas recirculation valve results in different exhaust gas recirculation rates.*
- *Differing exhaust gas recirculation rates can also be caused by a sticking EGR valve ⇒ Rep. Gr. 26 .*

Display group 003 at idle (engine control units as of data level D05)

This display group is used for checking exhaust gas recirculation. The exhaust gas recirculation valve -N18- is alternately opened and closed for 10 seconds. If specifications are not attained:

System in basic setting 3			→	▾ Indicated on display
1000 rpm	EGR n. active	430 mg/S	430 mg/S	
				Air flow detection 2 by air mass meter 2 -G246- • 370 to 480 mg / stroke with EGR not active: OK
				Air flow detection 1 by air mass meter -G70- • 370 to 480 mg / stroke with EGR not active: OK
				Exhaust gas recirculation status • EGR not active
				Engine speed

Note

- *The difference in air flow between display zones 3 and 4 must not exceed 100 mg/S.*
- *Incorrect actuation of the vacuum for the exhaust gas recirculation valve results in different exhaust gas recirculation rates.*
- *Differing exhaust gas recirculation rates can also be caused by a sticking EGR valve ⇒ Rep. Gr. 26 .*

Display group 003 at idle (engine control units as of data level D05)

This display group is used for checking exhaust gas recirculation. The exhaust gas recirculation valve -N18- is alternately opened and closed for 10 seconds.

System in basic setting 3		→	▾ Indicated on display

1000 rpm	EGR active	180 mg/S	180 mg/S	
				Air flow detection 2 by air mass meter 2 -G246- • 100 to 200 mg / stroke with EGR active: OK
				Air flow detection 1 by air mass meter -G70- • 100 to 200 mg / stroke with EGR active: OK
				Exhaust gas recirculation status • EGR active
				Engine speed

Note

- *The difference in air flow between display zones 3 and 4 must not exceed 100 mg/S.*
- *Incorrect actuation of the vacuum for the exhaust gas recirculation valve results in different exhaust gas recirculation rates.*
- *Differing exhaust gas recirculation rates can also be caused by a sticking EGR valve ⇒ Rep. Gr. 26 .*

Display group 033 at idle

This display group is used for checking charge pressure control. The charge pressure control solenoid valve -N75- is opened and closed alternately for 10 seconds.

The turbochargers are actuated alternately with the duty cycles “low delivery” and “full delivery”. In one period, the right turbocharger is actuated at “full delivery” and the left turbocharger is simultaneously actuated at “low delivery”. In the next period, the turbochargers are actuated with interchanged duty cycles.

System in basic setting 33			→	▾ Indicated on display
1450 rpm	Turbocharger 1 on	600 mg / stroke	200 mg / stroke	
				Air flow 2 specification: 100...300 mg / stroke
				Air flow 1 specification: 550...800 mg / stroke
				Charge pressure control solenoid valve -N75-
				Engine speed

Note

- *Incorrect actuation of the vacuum for the turbochargers results in different turbocharger delivery rates.*
- *Different turbocharger settings may cause the delivery rate of the turbochargers to fluctuate ⇒ Rep. Gr. 21 .*

Display group 033 at idle

This display group is used for checking charge pressure control. Opening and closing take place alternately for 10 seconds.

Charge pressure control solenoid valve -N75-

The turbochargers are actuated alternately with the duty cycles “low delivery” and “full delivery”. In one period, the right turbocharger is actuated at “full delivery” and the left turbocharger is simultaneously actuated at “low delivery”. In the next period, the turbochargers are actuated with interchanged duty cycles.

System in basic setting 33			→	▾ Indicated on display
1450 rpm	Turbocharger 2 on	200 mg / stroke	600 mg / stroke	
			Air flow 2 specification: 550...800 mg / stroke	
		Air flow 1 specification: 100...300 mg / stroke		
	Charge pressure control solenoid valve			
Engine speed				

Note

- *Incorrect actuation of the vacuum for the turbochargers results in different turbocharger delivery rates.*
- *Different turbocharger settings may cause the delivery rate of the turbochargers to fluctuate ⇒ Rep. Gr. 21 .*

4 Encoding engine control units 1 and 2

Note

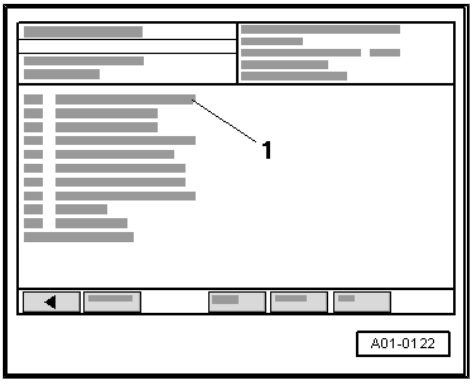
- *If encoding not corresponding to the vehicle is displayed in one of the two engine control units or if one of the engine control units has been replaced, the applicable control unit must be encoded.*
- *A 5-position code must always be displayed during control unit identification.*
- *Incorrect encoding may lead to higher emission levels and increased strain on the automatic gearbox resulting from harsh gearshift jolts.*

The following test is identical for both engine control units.

– Connect up fault reader and use “address word” 01 and “address word” 11 to select engine electronics 1 and 2 respectively. When doing this, the ignition must be switched on.

Display:

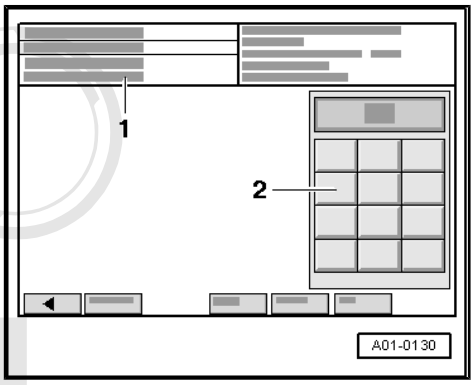
– From list -1-, select diagnosis function “07 - Encoding control unit”.



Display:

1 - Enter code word

– Use keypad -2- to enter control unit code as per encoding table.



Compile the code number as follows (example):

Audi A8	00			
Not used		0		
Emission standard EU III			1	
4WD with ESP Automatic gearbox				6
Code number	00	0	1	6

Encoding options for diesel direct injection system control unit - J248- and diesel direct injection system control unit 2 -J494-

Vehicle model		Not used		Country/emission standard		Gearbox	
00 =	Audi A8	0 =	Display 0	0 =	---	0 =	---
01 =	---	1 =	---	1 =	EU III	1 =	---
02 =	---	2 =	---	2 =	---	2 =	---
03 =	---	3 =	---	3 =	---	3 =	---
04 =	---	4 =	---	4 =	---	4 =	---

Vehicle model	Not used	Country/emission standard	Gearbox
05 = ---	5 = ---	5 = ---	5 = ---
06 = ---	6 = ---	6 = ---	6 = Automatic gearbox 4WD with ESP

Note

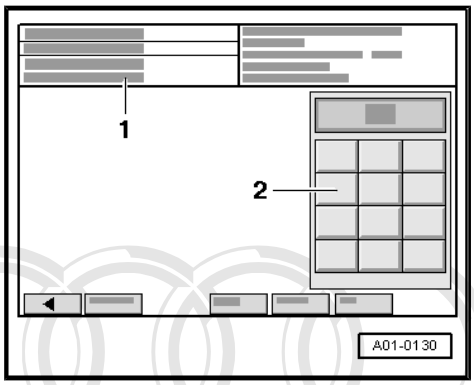
The abbreviation “ESP” stands for Electronic Stability Program

– Confirm entry by touching Q-key.

Display:

1 - Encoding in progress

– Wait until next display appears.



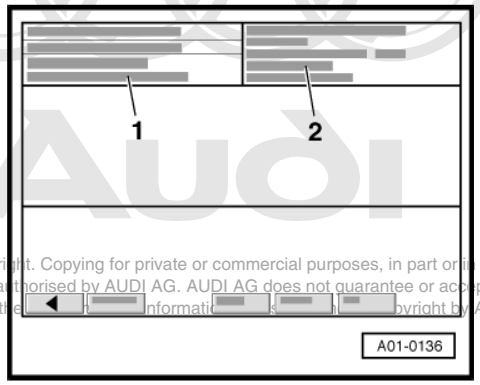
Display:

1 - Vehicle system encoding completed

2 - Control unit identification with new code

- (old code in brackets)

– Terminate function “07 - Encoding control unit” by touching ▪ key.



5 Reading measured value block

Safety precautions

Note the following if testers and measuring instruments have to be used during a test drive:

WARNING

- *When performing measurement and test drives, always attach the fault reader to the rear seat and have it operated from there by a second person.*
- *If measuring instruments and testers were to be operated from the front passenger's seat, the person sitting there could be seriously injured by triggering of the front passenger's airbag in the event of an accident.*

Test conditions:

-
- Coolant temperature at least 80 °C
- Electrical equipment switched off (radiator fan must not run during the test)
- Air conditioner switched off
- Selector lever set to P or N

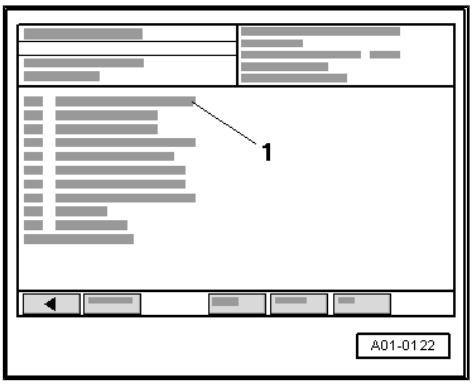
– Connect up fault reader and select vehicle system “01 - Engine electronics” from list. When doing this, the ignition must be switched on.

Or, depending on desired operation:

– Start engine.

Display:

– From list -1-, select diagnosis function “08 - Reading measured value block”.



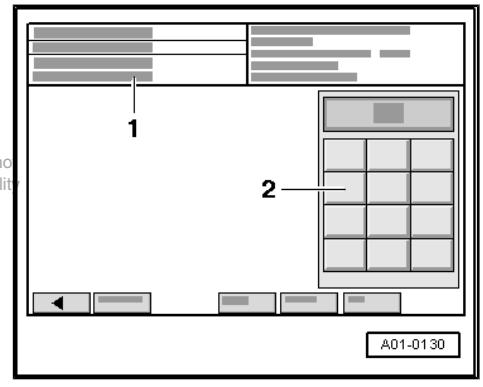
Display:

1 - Enter display group

– Use keypad -2- to enter desired three-position display group number and confirm entry by touching Q key.

Note

The choice of display group number depends on which functions and components are to be tested.



Display:

1 - Reading measured value block

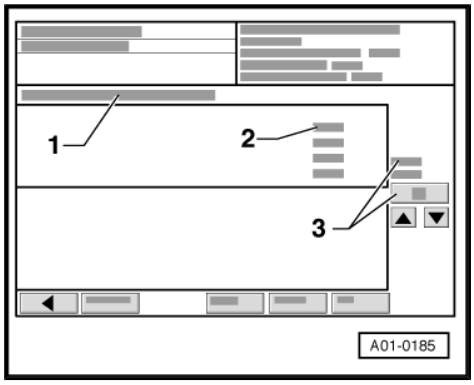
2 - Display zone 1

- Display zone 2

- Display zone 3

- Display zone 4

3 - Display group X



List of display groups

Display group number	Indicated on display	Designation
00 General vehicle check	Read measured value block 0 1 2 3 4 5 6 7 8 9 10	1 = Engine speed 2 = Commencement of injection 3 = Accelerator position 4 = Injection quantity 5 = Intake manifold pressure (charge pressure) 6 = Atmospheric pressure (ambient pressure) 7 = Coolant temperature 8 = Intake air temperature 9 = Fuel temperature 1 0 = Intake air mass
01 Injection quantity	Read measured value block 1 1 2 3 4	1 = Engine speed 2 = Injection quantity 3 = Rail pressure 4 = Coolant temperature

Display group number	Indicated on display	Designation
02 Idling speed	Read measured value block 2 1 2 3 4	1 = Engine speed 2 = Accelerator position 3 = Operating status 0 0 0 0 1 Air conditioner compressor on 0 0 0 1 0 Ignore 0 0 1 0 0 Idling speed switch closed 0 1 0 0 0 Kickdown switch closed 1 0 0 0 0 Idling speed increased on account of: • Detection of acceleration and braking • Detection of system fault 4 = Coolant temperature

Measured value block 03 for vehicles with data level up to D04 (can be seen from control unit identification)

The control unit identification appears on the fault reader display, e.g.:

Display group number	Indicated on display	Designation
03 Exhaust gas recirculation	Read measured value block 3 1 2 3 4	1 = Engine speed 2 = Intake air mass (specification for total air mass) 3 = Intake air mass (actual value for total air mass) 4 = Duty cycle (actuation) of exhaust gas recirculation valve -N18-

Measured value block 03 for vehicles with data level as of D05 (can be seen from control unit identification)

The control unit identification appears on the fault reader display, e.g.:

Display group number	Indicated on display	Designation
03 Exhaust gas recirculation	Read measured value block 3 1 2 3 4	1 = Engine speed 2 = Intake air mass (specification for total air mass) 3 = Air flow detection 1 by air mass meter -G70- 4 = Air flow detection 2 by air mass meter 2 -G246-

Display group number	Indicated on display	Designation
04 Main injection	Read measured value block 4 1 2 3 4	1 = Engine speed 2 = Commencement of main injection actuation 3 = Duration of main injection actuation 4 = Rail pressure
05 Starting conditions	Read measured value block 5 1 2 3 4	1 = Engine speed 2 = Injection quantity for starting (stored from last start) 3 = Synchronisation status 4 = Coolant temperature
06 Switch positions	Read measured value block 6 1 2 3 4	1 = Vehicle speed 2 = Brake/clutch switch: X X 1 Brake light switch -F closed X 1 X Brake pedal switch -F47- open 1 X X Clutch pedal switch -F36- open (vehicles with manual gearbox only)

Display group number	Indicated on display	Designation
06 Switch positions	Read measured value block 6 1 2 3 4	3 = Cruise control system (CCS) operating element: X X X X X 1 CCS switched on X X X X 1 X CCS off with memory X X X 1 X X Deceleration X X 1 X X X Resume/acceleration X 1 X X X X Brake pedal pressed 1 X X X X X Clutch pedal pressed (vehicles with manual gearbox only)

Display group number	Indicated on display	Designation
06 Switch positions	Read measured value block 6 1 2 3 4	4 = Operating status of cruise control system: 0 Control unit with cruise control system switched off 1 Cruise control system switched on 2 Acceleration 4 Deceleration 8 Resume 1 6 Brake pressed 3 2 Maintain speed 6 4 Ignore 1 2 8 Ignore 2 5 5 Control unit without CCS function

Display group number	Indicated on display	Designation
07 Temperatures	Read measured value block 7 1 2 3 4	1 = Fuel temperature 2 = Oil temperature 3 = Intake air temperature (in air mass meter -G70-) 4 = Coolant temperature
08 Injection quantity limitation	Read measured value block 8 1 2 3 4	1 = Engine speed 2 = Desired injection quantity (driver input via accelerator pedal) 3 = Injection quantity limitation via engine speed (torque limitation) 4 = Injection quantity limitation based on intake air mass (avoidance of smoke)
09	Read measured value block 9	1 = Desired injection quantity (driver input via accelerator pedal)

Display group number	Indicated on display	Designation
Injection quantity limitation	1 2 3 4	2 = Injection quantity (via automatic gearbox on changing gear) 3 = Injection quantity limitation by overrun torque limitation (MSR) 4 = Injection quantity limitation by traction control system (TCS)

Display group number	Indicated on display	Designation
10 Air quantities	Read measured value block 10 1 2 3 4	1 = Intake air mass 2 = Atmospheric pressure (joint component: altitude sender and diesel direct injection system control unit -J248-) 3 = Intake manifold pressure (charge pressure) 4 = Accelerator position
11 Charge air control	Read measured value block 11 1 2 3 4	1 = Engine speed 2 = Charge pressure (specified) 3 = Charge pressure (actual) 4 = Atmospheric pressure (joint component: altitude sender and diesel direct injection system control unit -J248-)
12 Glow plug system	Read measured value block 12 1 2 3 4	1 = Display can be ignored 2 = Glow period (in seconds) 3 = Supply voltage from control unit 4 = Coolant temperature

Display group number	Indicated on display	Designation
13 Idle Smooth running control	Read measured value block 13 1 2 3 4	1 = Injection quantity deviation/cylinder 1 2 = Injection quantity deviation/cylinder 2 3 = Injection quantity deviation/cylinder 3 4 = Injection quantity deviation/cylinder 4
14 Idle Smooth running control	Read measured value block 14 1 2 3 4	1 = Injection quantity deviation/cylinder 5 2 = Injection quantity deviation/cylinder 6 3 = Injection quantity deviation/cylinder 7 4 = Injection quantity deviation/cylinder 8
15 Fuel consumption	Read measured value block 15 1 2 3 4	1 = Engine speed 2 = Injection quantity (actual) 3 = Fuel consumption

Display group number	Indicated on display	Designation
		4 = Desired injection quantity (driver input via accelerator pedal)

Display group number	Indicated on display	Designation
16 Supplementary heater	Read measured value block 16 1 2 3 4	1 = Alternator capacity utilisation 2 = Supplementary heater switched off due to: X X X X 1 X X Engine speed not reached X X 1 X X X X Air conditioner not requesting heat output from supplementary heater 1 X X X X X X Supplementary heater switched off: At ambient temperature greater than 7 °C 3 = Ignore 4 = Engine control unit power supply

Display group number	Indicated on display	Designation
17	Read measured value block 17	Ignore
18	Read measured value block 18	Ignore
19 Cooling circuit	Read measured value block 19 1 2 3 4	1 = Engine speed 2 = Vehicle speed 3 = Coolant temperature 4 = Hydraulic fan capacity utilisation (duty cycle of radiator fan valve -N313-)
20 Supplementary heater [7)] (auxiliary heater)	Read measured value block 20 1 2 3 4	1 = Ambient temperature 2 = Fuel consumption of supplementary heater (auxiliary heater) 3 = Shutoff criteria 4 = Coolant temperature

7) The supplementary heater is fitted as standard. The auxiliary heater can be ordered as special equipment.

Display group number	Indicated on display	Designation
21 Bi-turbo control	Read measured value block 21 1 2 3 4	1 = Engine speed 2 = Turbocharger adjustment

Display group number	Indicated on display	Designation
		3 = Duty cycle of charge pressure control solenoid valve -N75- 4 = Duty cycle of charge pressure control solenoid valve 2 - N274-
22 Rail pressure	Read measured value block 22 1 2 3 4	1 = Engine speed 2 = Rail pressure (specified) 3 = Rail pressure (actual) 4 = Duty cycle of fuel pressure regulating valve -N276-
23 Pilot injection	Read measured value block 23 1 2 3 4	1 = Engine speed 2 = Commencement of pilot injection actuation 3 = Duration of pilot injection actuation 4 = Rail pressure

Display group number	Indicated on display	Designation
24 Capacitor voltage	Read measured value block 24 1 2 3 4	1 = Engine speed 2 = Capacitor voltage 1 (injectors of cylinder bank 1) 3 = Capacitor voltage 2 (injectors of cylinder bank 2) 4 = Battery voltage
25 Bi-turbo	Read measured value block 25 1 2 3 4	1 = Engine speed 2 = Charge pressure (actual) 3 = Air flow detection 1 by air mass meter -G70- 4 = Air flow detection 2 by air mass meter 2 -G246-
26	Read measured value block 26	Ignore

Display group number	Indicated on display	Designation
27 Electric fan	Read measured value block 27 1 2 3 4	1 = Air conditioner high-pressure switch 2 = Coolant temperature 3 = 1. Fan speed 4 = 2. Fan speed
28	Read measured value block 28	Ignore
29	Read measured value block 29	Ignore

Display group number	Indicated on display	Designation
30 Position of camshaft flanks	Read measured value block 30 1 2 3 4	1 = Engine speed 2 = No display 3 = Position of camshafts (inlet) 4 = Position of camshafts (exhaust)
31	Read measured value block 31	Ignore

Measured value block 32 for vehicles as of data level D05 only (can be seen from control unit identification)

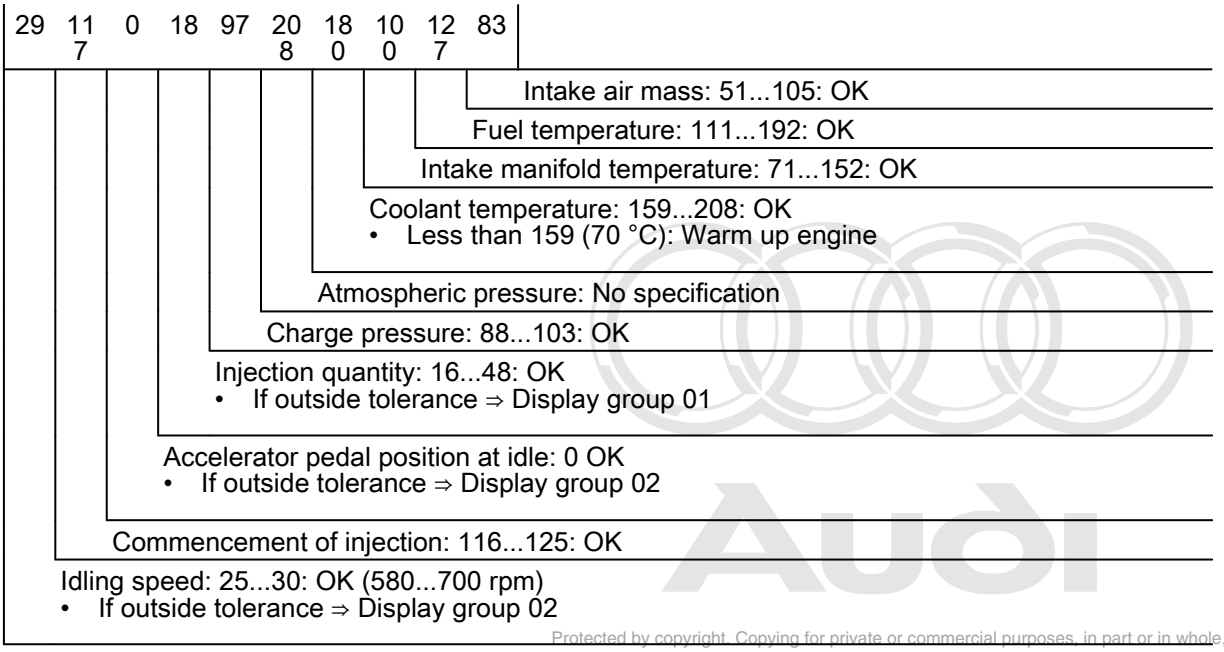
The control unit identification appears on the fault reader display, e.g.:

Display group number	Indicated on display	Designation
32 Exhaust gas recirculation	Read measured value block 32 1 2 3 4	1 = Engine speed 2 = Intake air mass (specification for total air mass) 3 = Intake air mass (actual value for total air mass) 4 = Duty cycle (actuation) of exhaust gas recirculation valve - N18-

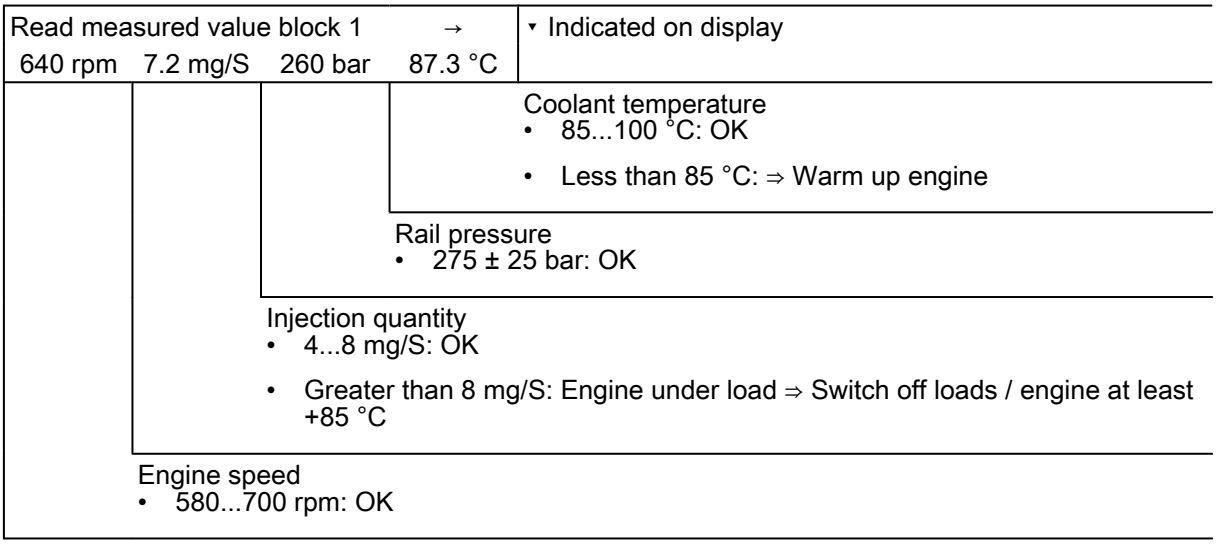
Display group number	Indicated on display	Designation
33 Bi-turbo	Read measured value block 33 1 2 3 4	1 = Engine speed 2 = Charge pressure (actual) 3 = Air flow 1 4 = Air flow 2
80 Control unit identification	Read measured value block 80 1 2 3 4	1 = Factory code 2 = Date of manufacture 3 = Manufacturer's modification status 4 = Serial number
125 CAN link	Read measured value block 125 1 2 3 4	1 = Gearbox control unit 2 = ABS (anti-lock braking system) control unit 3 = Dash panel insert 4 = Air conditioner control unit

Display group 00 at idle (coolant temperature not below +85 °C)

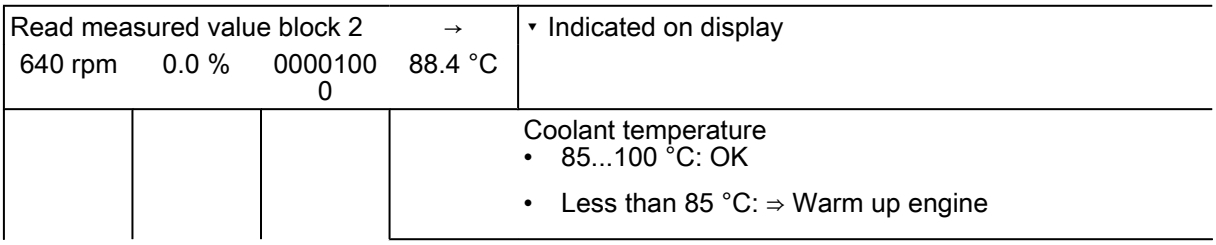
Read measured value block 0 →	▾ Indicated on display



Display group 01 at idle (coolant temperature not below +85 °C)



Display group 02 at idle (coolant temperature not below +85 °C)



Operating status
- 0 1 0 0 0 0 0 0: Idling speed increased due to:

Discharged battery
Detection of acceleration and braking
Request from air conditioner
Supplementary heater on
- 0 0 0 0 1 0 0 0: Idling speed switch closed
- 0 0 0 0 0 0 0 1: Air conditioner signal ⇒ Switch off air conditioner
- 0 0 0 1 0 0 0 0: Kick-down switch (only check with ignition on)

Accelerator position
- 0.0 %: OK
- Greater than 0.0 %: Accelerator pedal position sender incorrectly set or defective ⇒ Adjusting ⇒ Rep. Gr. 20

Engine speed
- 580...700 rpm: OK

Display group 04 at idle (coolant temperature not below +85 °C)

Read measured value block 4 →	▾ Indicated on display
640 rpm 3.8° after TDC ms 265	

Rail pressure
- 275 ± 25 bar: OK

Duration of main injection actuation
- Ignore

Commencement of main injection actuation
- 3,3° ± 0,5°

Engine speed
- 580...700 rpm: OK

Display group 04 on attempted starting (if engine does not start)

Read measured value block 4 →	▾ Indicated on display
rpm after TDC 0.4 ms 100	

Rail pressure
- At approx. 20 °C coolant temperature: approx. 150 bar rail pressure: OK
- Greater than 60 °C coolant temperature: approx. 100 bar rail pressure: OK

Duration of main injection actuation
- Greater than 0 ms: OK

Commencement of main injection actuation

Starting speed

Display group 05 on attempted starting (if engine does not start)

Read measured value block 5 →				▾ Indicated on display
rpm		0000010 0	14.3 °C	
				Coolant temperature
				Synchronisation status (crankshaft/camshaft assignment) • 00000100: OK • 00000400: OK • Display not OK: Interrogate fault memory, power supply too low
				Injection quantity for starting • Governed by coolant temperature
				Starting speed

Display group 07 with ignition on (engine cold and not running)

Read measured value block 7 →				▾ Indicated on display
15.4 °C	16.5 °C	15.9 °C	16.7 °C	
				Coolant temperature (at coolant temperature sender -G62-)
				Intake air temperature (at intake air temperature sender -G42-)
				Oil temperature (at oil temperature sender -G8-)
				Fuel temperature (at fuel temperature sender -G81-)

Note

- *Temperature specifications cannot be given.*
- *When the engine has been allowed to cool down overnight for instance, the temperature values for fuel, intake manifold and coolant should obviously be more or less the same as the ambient temperature. In the event of a considerable deviation in any of the values, the corresponding sender is to be checked.*

Display group 08 at full load (test drive in 3rd or 4th gear, coolant temperature not below +85 °C)

Shift selector lever into Tiptronic gate and engage 3rd gear. Accelerate from 2500 rpm under full load (without kick-down) to 3500 rpm. Check display on tester (press Print) at roughly 3000 rpm.

Read measured value block 8 →				▾ Indicated on display
3000 rpm	47.5 mg/S	46.7 mg/S	43 mg/S	
				Injection quantity limitation on account of air mass detected (smoke limitation) • Greater than 40 mg/S: OK • Less than 40 mg/S: Inadequate air mass detected ⇒ Check air mass meter ⇒ page 110

Injection quantity limitation based on engine speed (torque limitation/ actual value) 45...47 mg/S: OK

- Less than 45 mg/S: Engine speed too high
- Always greater than 47 mg/S: Injection quantity increase due to tuning

Desired injection quantity (accelerator pedal position)

- Value lower than in display zone 3: Accelerator pedal not floored, incorrectly set or defective ⇒ Check

Engine speed 2500...3500 rpm: OK

> **WARNING**
>
> - *When performing measurement and test drives, always attach the fault reader to the rear seat and have it operated from there by a second person.*
> - *If measuring instruments and testers were to be operated from the front passenger's seat, the person sitting there could be seriously injured by triggering of the front passenger's airbag in the event of an accident.*

Display group 10 with vehicle stationary (coolant temperature not below +85 °C). Press accelerator pedal and maintain engine speed between 3100 and 3200 rpm.

Read measured value block 10			→	▸ Indicated on display
500 mg/S	1010 mbar	1350 mbar	%	

4. Accelerator position:
3. Current charge pressure: 1200...1500 mbar: OK
   Outside tolerance: Charge pressure control defective ⇒ Display group 11
2. Current atmospheric pressure: No specification
1. Intake air mass: 475...650 mg/S: OK
   - Less than 475 mg/S: Engine speed below 2950 rpm or above 3050 rpm

   Charge pressure too low ⇒ Heed display zone 3
   Unmetered air between air mass meter and turbocharger
   Air mass meter defective

Display group 11 at full load (test drive in 3rd and 4th gear, coolant temperature not below +85 °C)

Shift selector lever into Tiptronic gate and engage 3rd gear. Accelerate from 2000 rpm under full load (without kick-down) to 3000 rpm. Check display on tester (press Print) at roughly 2500 rpm.

Read measured value block 11			→	▸ Indicated on display
3340 rpm	1948 mbar	1917 mbar	57 %	

4. Duty cycle (actuation) of charge pressure control solenoid valve -N75-

Current charge pressure
- As specified charge pressure in display zone 2 (tolerance ±100 mbar): OK
- Insufficient charge pressure: No charge pressure control ⇒ Check
- Excessive charge pressure: Charge pressure control solenoid valve -N75- sticking

Charge pressure control pressure hose disconnected or clogged
Vanes or linkage seized, vacuum unit defective
⇒ Check charge pressure

Specified charge pressure requested by control unit
- 1800...2250 mbar: OK
- Greater than 2250 mbar: Charge pressure increase due to tuning

Engine speed 2900...4000 rpm: OK

WARNING

- *When performing measurement and test drives, always attach the fault reader to the rear seat and have it operated from there by a second person.*
- *If measuring instruments and testers were to be operated from the front passenger's seat, the person sitting there could be seriously injured by triggering of the front passenger's airbag in the event of an accident.*

Display group 13 at idle (coolant temperature not below +85 °C)

Read measured value block 13 →				▾ Indicated on display
-0.00 mg/S	-0.24 mg/S	0,00 mg/S	0,00 mg/S	

Injection quantity deviation/cylinder 4
- -2.49 to 2.48 mg/stroke: OK
- Above 2.49 mg/stroke: Check compression / mechanical damage in cylinder / injector replacement

Injection quantity deviation/cylinder 3
- -2.49 to 2.48 mg/stroke: OK
- Above 2.49 mg/stroke: Check compression / mechanical damage in cylinder / injector replacement

Injection quantity deviation/cylinder 2
- -2.49 to 2.48 mg/stroke: OK
- Above 2.49 mg/stroke: Check compression / mechanical damage in cylinder / injector replacement

Injection quantity deviation/cylinder 1
- -2.49 to 2.48 mg/stroke: OK
- Above 2.49 mg/stroke: Check compression / mechanical damage in cylinder / injector replacement

Display group 14 at idle (coolant temperature not below +85 °C)

Read measured value block 14 → ▾ Indicated on display

-0.42 mg/S | 0.00 mg/S | -0.54 mg/S | -0.59 mg/S

Injection quantity deviation/cylinder 8
- -2.49 to 2.48 mg/stroke: OK
- Above 2.49 mg/stroke: Check compression / mechanical damage in cylinder / injector replacement

Injection quantity deviation/cylinder 7
- -2.49 to 2.48 mg/stroke: OK
- Above 2.49 mg/stroke: Check compression / mechanical damage in cylinder / injector replacement

Injection quantity deviation/cylinder 6
- -2.49 to 2.48 mg/stroke: OK
- Above 2.49 mg/stroke: Check compression / mechanical damage in cylinder / injector replacement

Injection quantity deviation/cylinder 5
- -2.49 to 2.48 mg/stroke: OK
- Above 2.49 mg/stroke: Check compression / mechanical damage in cylinder / injector replacement

Note

- *Notes on display groups 13 and 14:*
- *The injection system features idling speed smooth running control. Differences in power between the individual cylinders (component tolerances, injector delivery, compression etc.) can be detected and compensation provided by way of selective injection quantity metering (for each individual cylinder) at idle.*
- *If the control unit detects a deviation, the cylinder concerned is immediately supplied with a higher or lower injection quantity until the engine is running "smoothly" again.*
- *+... mg/S: There is less power at the cylinder concerned and this is therefore supplied with more fuel.*
- *-... mg/S: There is more power at the cylinder concerned and this is therefore supplied with less fuel.*
- *Display groups 13 and 14 indicate the deviations in injection quantity for cylinder banks 1 and 2 respectively. If there is a considerable difference between the injection quantities for the two cylinder banks, check: Toothed belt tension, tensioning roller and timing.*
- *If the value for one or more cylinders is +2.49 mg/S, it can be assumed that an injector is defective. The defective injector may influence other injectors preceding it in the firing order (1-5-4-8-6-3-7-2-). This means that even if the value for several injectors is +2.49 mg/S, only the last injector in the firing order is defective.*
- *The defective injector can also be established by accelerating slightly on reading out the measured values (maximum speed 1500 rpm). This causes all cylinders with the exception of one to consecutively depart from a value of +2.49 mg/S. The exception indicates the defective injector.*
- *If the vehicle has already been fitted with injectors with index H, only the defective injector is to be replaced. Otherwise, all 8 injectors are to be replaced, as the possibility of subsequent damage to the other injectors cannot be precluded.*
- *Removing and installing injectors* *⇒ page 85*

Display group 021 with vehicle stationary (coolant temperature not below +85 °C). Press accelerator pedal and maintain engine speed between 2960 and 3040 rpm.

Read measured value block 21 →				▾ Indicated on display
3000 rpm	3.9 %	65 %	67 %	
				Duty cycle of charge pressure control solenoid valve 2 - N274-
				Duty cycle of charge pressure control solenoid valve -N75-
				Turbocharger adjustment • -5 ... +5%: OK. Difference between display zones 3 and 4
				Engine speed • 2960...3040 rpm: OK

Display group 022 rail pressure at idle (coolant temperature not below +85 °C)

Read measured value block 22 →				▾ Indicated on display
640 rpm	265	265	16 %	
				Duty cycle of fuel pressure regulating valve -N276- • Less than 25%: OK
				Rail pressure (actual value) • As display zone 2 ± 10 bar: OK
				Rail pressure (specification) • 275 ± 25 bar: OK
				Engine speed • 580...700 rpm: OK

Display group 022 rail pressure at full load (coolant temperature not below +85 °C). Shift selector lever into Tiptronic gate and engage 3rd gear. Accelerate from 2500 rpm under full load (without kick-down) to 3500 rpm. Check display on tester (press Print) at roughly 3000 rpm.

Read measured value block 22 →				▾ Indicated on display
3000 rpm	1350 bar	1345 bar	16 %	
				Duty cycle of fuel pressure regulating valve -N276- • 30...50%: OK
				Rail pressure (actual value) • As display zone 2 ± 20 bar: OK
				Rail pressure (specification) • Approx. 1350 bar: OK
				Engine speed

WARNING

- *When performing measurement and test drives, always attach the fault reader to the rear seat and have it operated from there by a second person.*
- *If measuring instruments and testers were to be operated from the front passenger's seat, the person sitting there could be seriously injured by triggering of the front passenger's airbag in the event of an accident.*

Display group 025 at idle: Air flow detection (coolant temperature not below +85 °C)

Read measured value block 25 →				▾ Indicated on display
640 rpm	1010 mbar	405 mg/S	365 mg/S	
				Air flow detection 2 by air mass meter 2 -G246-

Air flow detection 1 by air mass meter -G70-

Charge pressure (actual value)

Engine speed
- 580...700 rpm: OK

Display group 080 with ignition on

Read measured value block 80 →	▾ Indicated on display

Serial number

Manufacturer's modification status

Date of manufacture

Factory code

Display group 125 with ignition on

Read measured value block 125 →	▾ Indicated on display

1 1 1 1

Air conditioner CAN bus link
- No display = OK
- 1 = OK
- 0 = Not OK

Dash panel insert CAN bus link
- 1 = OK
- 0 = Not OK

Anti-lock braking system ABS CAN bus link
- 1 = OK
- 0 = Not OK

Gearbox CAN bus link
- 1 = OK
- 0 = Not OK

6 Idling speed and glow period adaption

The adaption function permits alteration of the idling speed and glow period within a specified framework.

– Connect fault reader and select engine electronics control unit 1 with “address word” 01. The engine must be idling when doing so.

– Press key for “adaption” function.

– Enter desired channel number.

Alteration of	Channel
Idling speed	02
Glow period	12

There are two options for altering the adaption value: Step-by-step or direct adaption.

23 – Mixture preparation - injection

1 Servicing diesel direct injection system

1.1 Safety precautions

Note the following if testers and measuring instruments have to be used during a test drive:

> **WARNING**
>
> - *When performing measurement and test drives, always attach the fault reader to the rear seat and have it operated from there by a second person.*
> - *If measuring instruments and testers were to be operated from the front passenger's seat, the person sitting there could be seriously injured by triggering of the front passenger's airbag in the event of an accident.*

1.2 Avoidance of injury and/or damage to the injection and glow plug system

- Users of pacemakers should not lean over the engine compartment with the engine running, as the injectors are pulsed with high voltage.
- Due to the danger of injury and fire, fuel pipes are not to be disconnected with the engine running and for the first 30 seconds after switching off the engine.
- Always switch off the ignition before connecting or disconnecting injection and glow plug system wiring or measuring instrument leads.
- Always switch off the ignition before cleaning the engine.
- Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.
- Certain tests may lead to a fault being detected by the control unit and stored. The fault memory should therefore be interrogated and (if necessary) erased after completing all tests and performing any repair work.

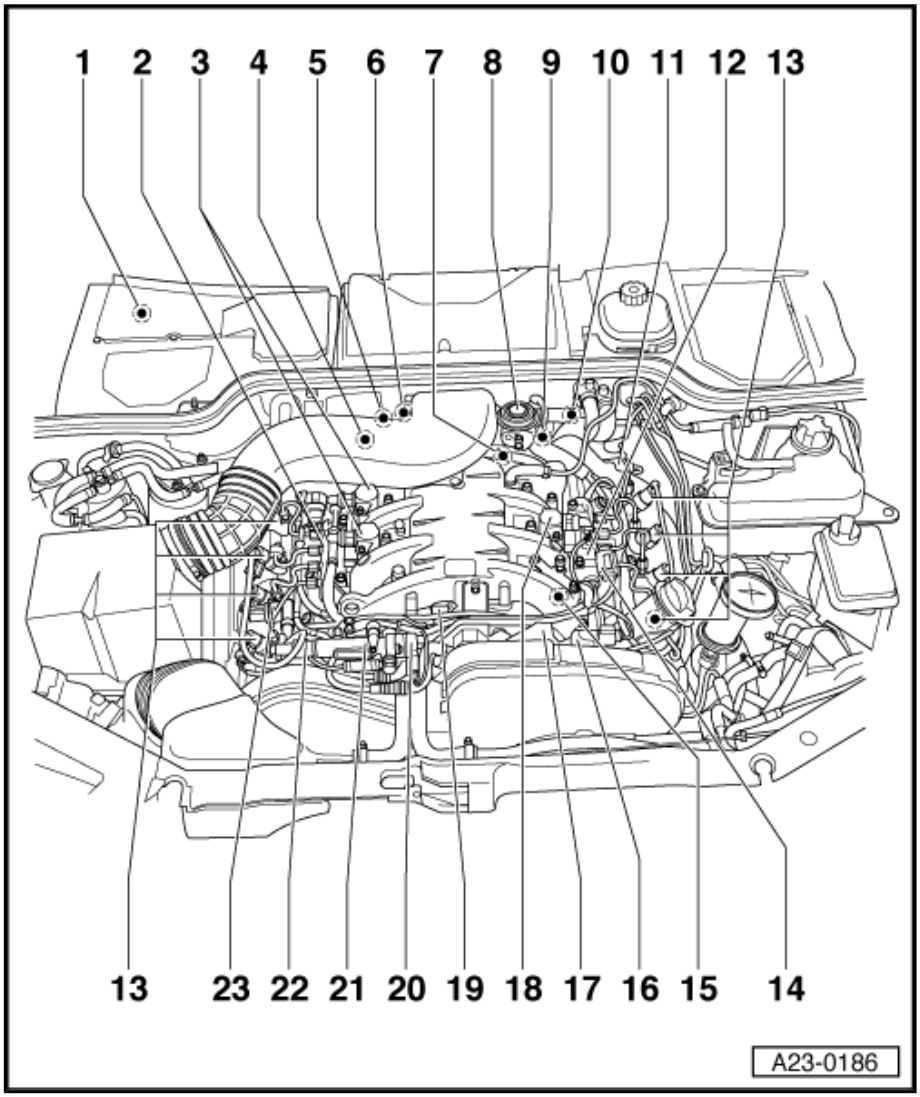
1.3 Rules for cleanliness and instructions for working on fuel system

- Clean working area and tools before working on the injection system.
- Thoroughly clean joints and surrounding areas prior to disconnection.
- On disassembly, immediately seal all open connections with suitable clean protective caps.
- Do not remove protective caps from any components until immediately prior to installation. After removal, components should be kept in new packaging which can be sealed (not cardboard, only plastic bags and, if available, original wrapping of new components).

- Before fitting, visually inspect injectors and installation locations for damage and fluff. Make sure the injector bores are clean. Wipe out if necessary using a clean cloth, taking care not to cause damage. Do not use sharp objects of any kind.
- If components are to be re-used, always mark the high-pressure pipes on removal. High-pressure pipes must always be re-installed in their original positions (cylinder).
- The following components and seals/O-rings must always be replaced when injectors are removed and installed: “Copper washer”, “O-ring for injector bore”, “O-ring for injector return connection”.
- The following components and seals/O-rings are to be replaced together with the injector: “Clamp” “copper washer” “O-rings”
- Always fit new copper seals for the injectors. Check all new O-rings for damage before installing. Lubricate O-rings lightly with assembly oil or clean engine oil before installing.
- Take care not to damage the injector when removing the old copper seal.
- Align the high-pressure pipes such that they are not subject to strain. First hand-tighten all connections and then tighten to torque.
- Never attempt to bend high-pressure pipes into shape.
- When working on any part of the high-pressure system, tools may only be used for securing and unfastening pipes. All other assembly and disassembly operations must be performed by hand without the use of any tools.
- Press the return pipes by hand onto the injectors from above until they are heard to engage at each injector. Then press in the fastener. Check for firm attachment and leakage of return pipes by pulling them upwards.
- All cable ties unfastened or severed on removal must be re-attached in the same position on installation.
- When the fuel system is open: Do not work with compressed air if this can be avoided. Do not move the vehicle unless absolutely necessary.
- It should also be ensured that diesel fuel does not come into contact with the coolant hoses. Should this occur, the hoses must be cleaned immediately. Damaged hoses must be renewed.

1.4 Exploded view of fitting locations

Components A to I are not shown in the exploded view.



1 - Electronics box

- ❑ Diesel direct injection system control unit -J248- with altitude sender
- ❑ Diesel direct injection system control unit 2 -J494-
- ❑ Glow plug relay -J52-
- ❑ Glow plug relay 2 -J495-

2 - High-pressure accumulator (rail)

- ❑ Cylinder bank 1

3 - Exhaust gas recirculation valve -N18- and exhaust gas recirculation valve 2 -N213-

4 - Coolant temperature sender -G62-

5 - Air mass meter -G70-

- ❑ With intake air temperature sender -G42-

6 - Mechanical exhaust gas recirculation valve

7 - Air mass meter 2 -G246-

8 - Mechanical exhaust gas recirculation valve

9 - Engine speed sender -G28-

10 - Connector

- ❑ For engine speed sender -G28-

11 - Hall sender -G40-

12 - High-pressure accumulator (rail)

- ❑ Cylinder bank 2

13 - Injectors

- ❑ Cylinder bank 1
- ❑ Cylinder bank 2

14 - Connector

- ❑ For glow plugs 5...8
- ❑ Connector for glow plugs 1...4 on high-pressure accumulator (rail) of cylinder bank 1

15 - Intake manifold pressure sender -G71-

16 - Throttle valve linkage

17 - High-pressure pump

- ❑ With fuel metering valve -N290-

18 - Variable intake manifold flap changeover valve -N239-

- ❑ Checking ⇒ page 117

19 - Connector

- ❑ Fuel metering valve -N290-

20 - Fuel pressure regulating valve -N276-

21 - Distributor housing (function block)

22 - Fuel pressure sender -G247-

23 - Fuel temperature sender -G81-

A - Brake light switch -F- and brake pedal switch -F47-

- ❑ In footwell on pedal bracket at brake pedal

B - Accelerator pedal position sender -G79-

- ❑ In footwell on pedal bracket at accelerator pedal

C - Glow plug relay -J52-

- ❑ Relay and fuse carrier in electronics box in plenum chamber, relay position 8

D - Glow plug relay 2 -J495-

- ❑ Relay and fuse carrier in electronics box in plenum chamber, relay position 2

E - Fuel pump relay -J17-

- ❑ Relay carrier in electronics box in passenger's footwell, relay position 2

F - Terminal 30 voltage supply relay -J317-

- ❑ Micro-central electrics in electronics box in passenger's footwell, relay position 4

G - Oil temperature sender -G8-

- ❑ In oil filter bracket, refer to exploded view ⇒ Rep. Gr. 17

H - Oil pressure switch -F1-

- ❑ In oil filter bracket
- ❑ Checking ⇒ Rep. Gr. 17

I - Exhaust gas recirculation valve -N18- and charge pressure control solenoid valve 2 -N274-

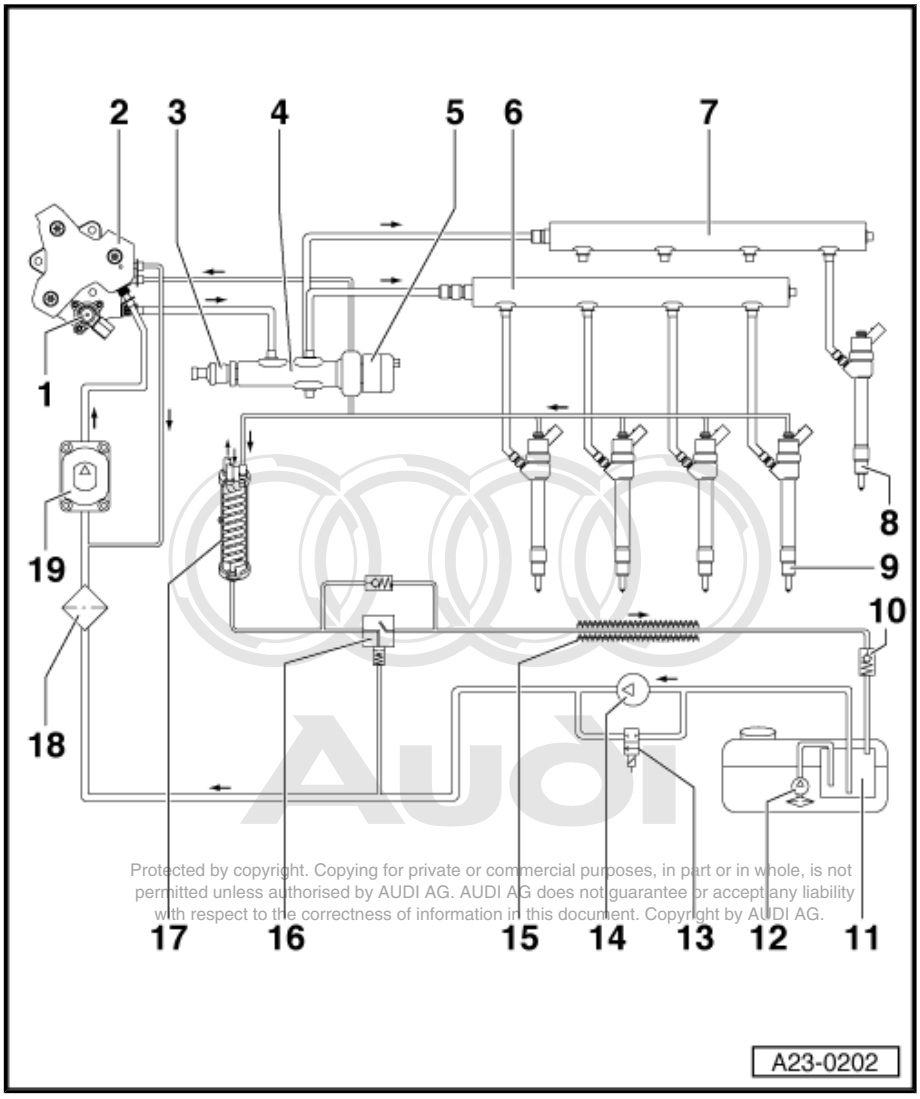
- ❑ Connection diagram ⇒ page 52

1.5 System layout

Caution

Always read rules for cleanliness and instructions for working on fuel system ⇒ page 47 .

Follow these instructions before starting work and while working on the fuel system.



1 - Fuel metering valve -N290-

2 - High-pressure pump

3 - Fuel pressure sender -G247-

4 - Distributor housing with high-pressure control circuit

5 - Fuel pressure regulating valve -N276-

6 - Rail element (high-pressure accumulator)

- ❑ For cylinder bank 1

7 - Rail element (high-pressure accumulator)

- ❑ For cylinder bank 2

8 - Injectors

- ❑ 5 ... 8
- ❑ Cylinder bank 2

9 - Injectors

- ❑ 1 ... 4
- ❑ Cylinder bank 1

10 - Mechanical crash valve

11 - Baffle housing

12 - Fuel pre-supply pump -G6-

- ❑ Pre-supply pump

13 - Fuel bypass valve -N312-

14 - Fuel pump -G23-

15 - Fuel cooler (air)

- ❑ On underside of vehicle

16 - Bimetallic preheating valve

17 - Fuel cooler

- ❑ Water low-temperature circuit

18 - Fuel filter

19 - Gear pump

1.6 Connection diagram for charge pressure control

1 - Right turbocharger

2 - Left turbocharger

3 - To variable intake manifold flap changeover valve -N239-

4 - To exhaust gas recirculation valve -N18- and exhaust gas recirculation valve 2 -N213-

5 - Exhauster pump

6 - Brake servo

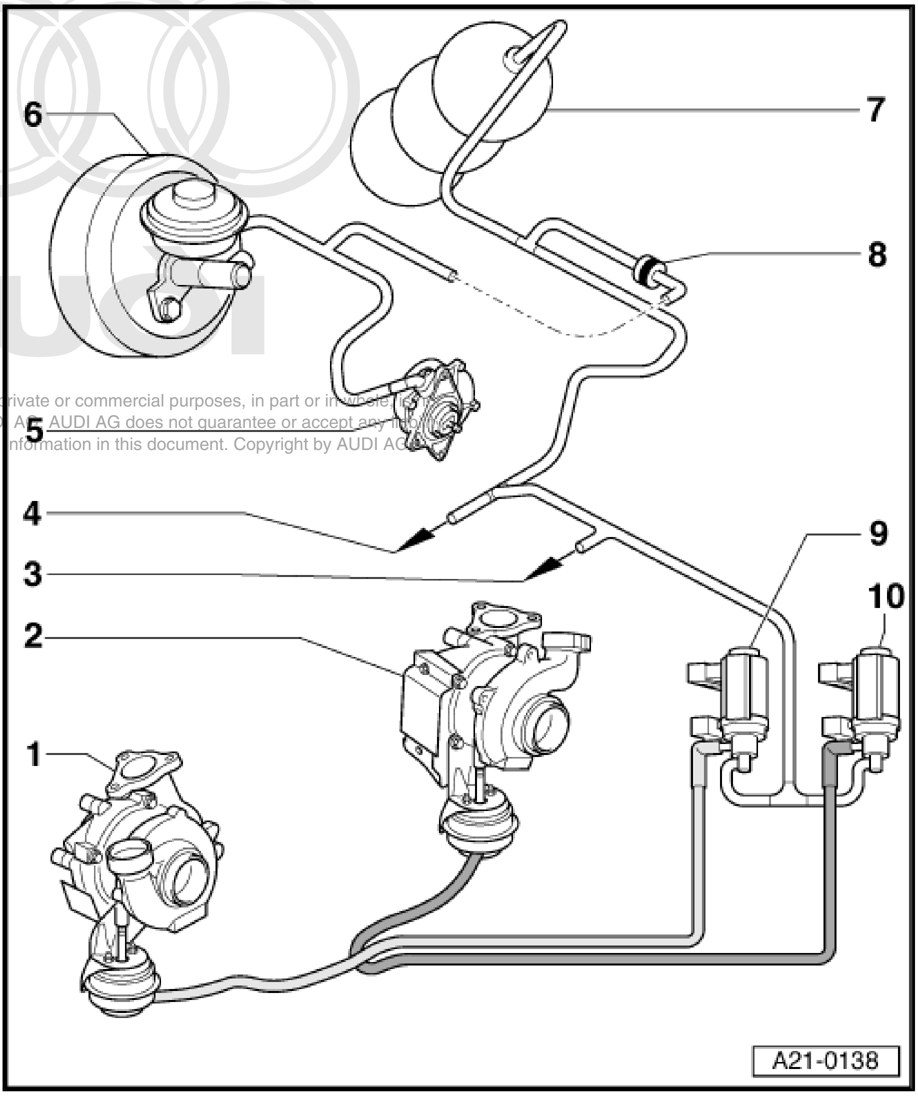
7 - Vacuum reservoir

- In front left wheel housing beneath liner

8 - Non-return valve

9 - Charge pressure control solenoid valve -N75-

10 - Charge pressure control solenoid valve 2 -N274-



1.7 Connection diagram for exhaust gas recirculation

1 - Mechanical exhaust gas recirculation valve

- ❑ For right cylinder bank

2 - Mechanical exhaust gas recirculation valve

- ❑ For left cylinder bank

3 - Exhauster pump

4 - Brake servo

5 - Vacuum reservoir

- ❑ In front left wheel housing beneath liner

6 - Non-return valve

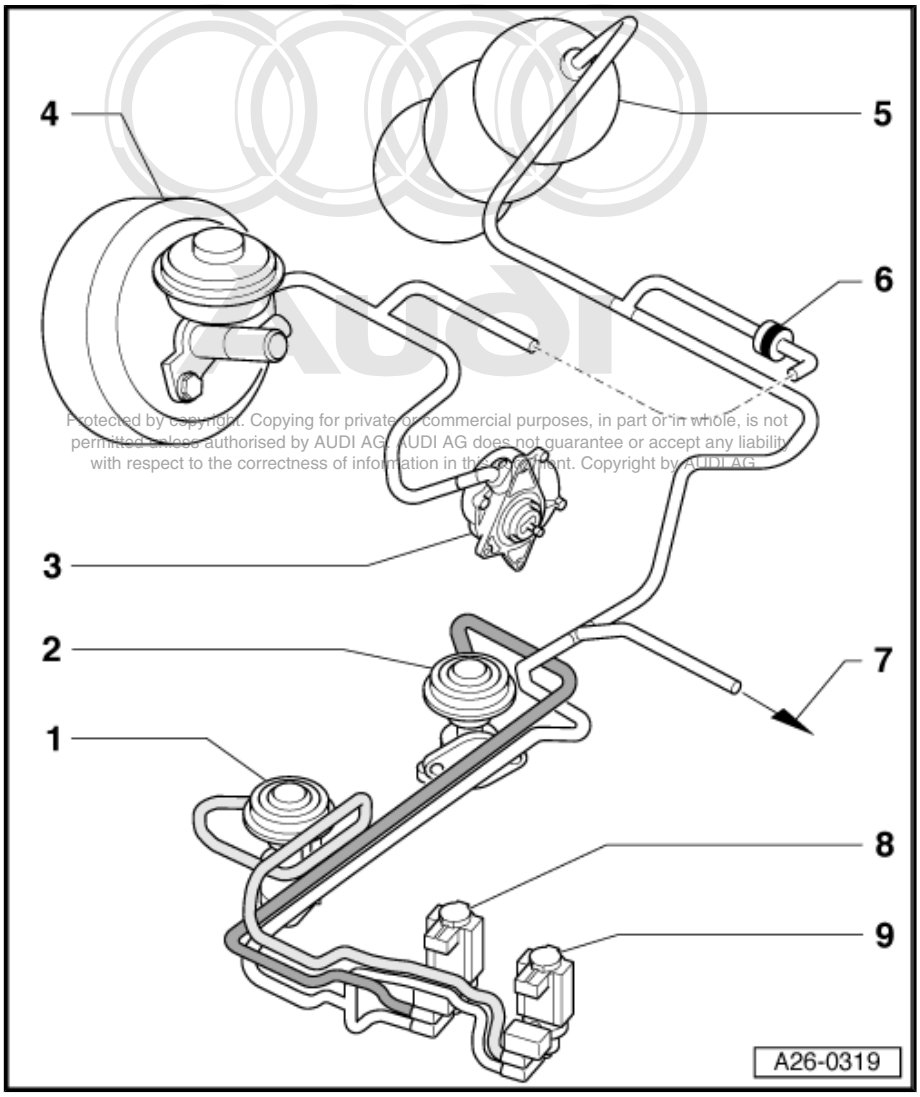
7 - To variable intake manifold flap changeover valve -N239- as well as to charge pressure control solenoid valve -N75- and charge pressure control solenoid valve 2 -N274-

8 - Exhaust gas recirculation valve 2 -N213-

- ❑ For left cylinder bank

9 - Exhaust gas recirculation valve -N18-

- ❑ For right cylinder bank

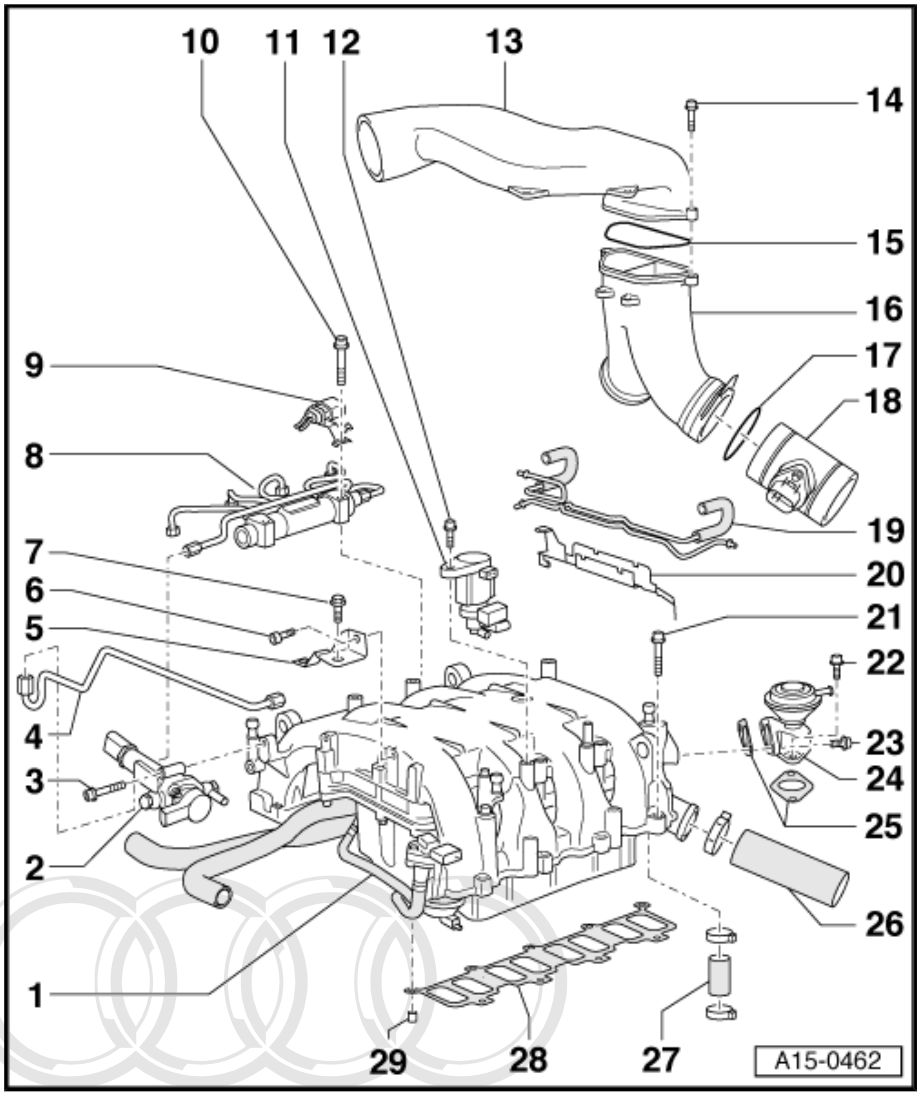


1.8 Exploded view of intake manifold

Caution

Always read rules for cleanliness and instructions for working on fuel system *⇒ page 47* *.*

Follow these instructions before starting work and while working on the fuel system.



1 - Intake manifold

- ❑ With charge air cooler
- ❑ With exhaust gas recirculation system cooler
- ❑ With two intake manifold flaps
- ❑ Cannot be dismantled
- ❑ Removing and installing ⇒ page 55

2 - Distributor housing

3 - Bolt

- ❑ 10 Nm

4 - Injector pipe

- ❑ 25 Nm
- ❑ Do not alter shape
- ❑ Removing and installing ⇒ page 85

5 - Retaining bracket

6 - Bolt

- ❑ 22 Nm

7 - Bolt

- ❑ 22 Nm

8 - Rail element (high-pressure accumulator)

- ❑ With injector pipes
- ❑ Tighten injector pipes to 25 Nm
- ❑ Do not attempt to bend injector pipes to a different shape

9 - Connector

- ❑ For glow plugs
- ❑ With holder

10 - Bolt

- ❑ 22 Nm

11 - Variable intake manifold flap changeover valve -N239-

- ❑ Checking ⇒ page 117

12 - Bolt

- ❑ 10 Nm

13 - Top air pipe

14 - Bolt

- ❑ 10 Nm

15 - Gasket

- ❑ Replace if damaged

16 - Rear air pipe

- ❑ Removing and installing ⇒ page 62

17 - O-ring

- ❑ Replace
- ❑ Moisten O-ring with fuel when fitting

- ❑ Do not use silicone-based lubricants

18 - Air mass meter -G70- (cylinder bank 1)/ air mass meter 2 -G246- (cylinder bank 2)

- ❑ Checking ⇒ page 110
- ❑ Removing and installing ⇒ page 115

19 - Vacuum pipes

20 - Holder

- ❑ For vacuum pipes and wiring harness

21 - Bolt

- ❑ 10 Nm
- ❑ Heed unfastening sequence
- ❑ Heed tightening sequence
- ❑ For sequence, refer to Removing and installing intake manifold ⇒ page 55

22 - Bolt

- ❑ 22 Nm

23 - Bolt

- ❑ 22 Nm

24 - Mechanical exhaust gas recirculation valve

- ❑ Checking ⇒ Rep. Gr. 26

25 - Gasket

- ❑ Replace

26 - Connecting hose

27 - Coolant hose

- ❑ Sever hose if necessary to remove intake manifold
- ❑ Secure with hose clamps

28 - Gasket

- ❑ Replace

29 - Dowel sleeve

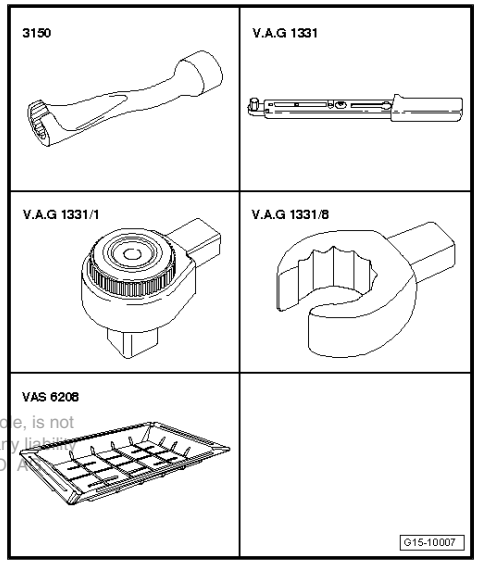
- ❑ 2x per cylinder head
- ❑ Take care to prevent dowel sleeve dropping into intake ducts

1.9 Removing and installing intake manifold

Special tools and workshop equipment required

- ♦ Drip tray for workshop hoist -VAS 6208-
- ♦ -V.A.G 1331;Drehmomentschlüssel- with -V.A.G 1331/1;Knarre-
- ♦ 14 mm open ring attachment -V.A.G 1331/8-

♦ 14 mm socket wrench -3150-



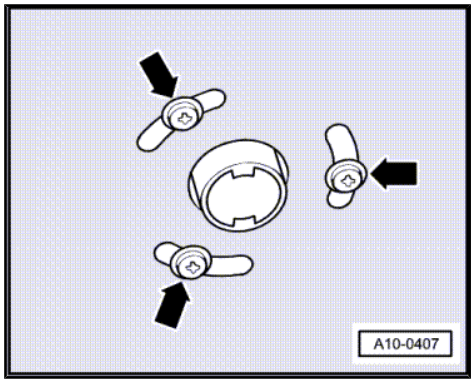
Removing

Caution

Always read rules for cleanliness and instructions for working on fuel system ⇒ page 47 .

Follow these instructions before starting work and while working on the fuel system.

– Screw out bolts -arrow- for auxiliary/supplementary heater exhaust pipe at noise insulation.

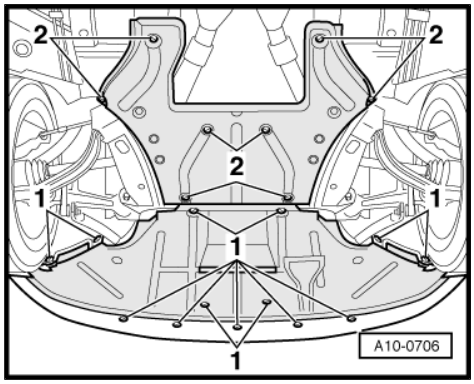


– Unfasten quick-release fasteners -1- and detach front noise insulation.

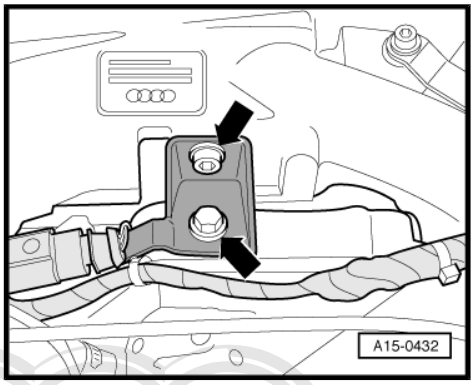
Note

Collect drained coolant in a clean container for re-use or disposal.

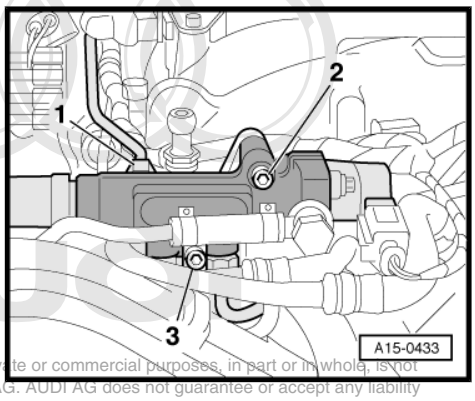
– Place drip tray for workshop hoist -VAS 6208- under engine.
– Open drain plugs -2- and -3- and drain off coolant at engine only.
– Remove rear air pipe ⇒ page 62 .



– Screw out bolts -arrows- at retaining bracket.
– Unscrew union nut -1- at distributor housing.



– Screw out bolts -2- and -3-.

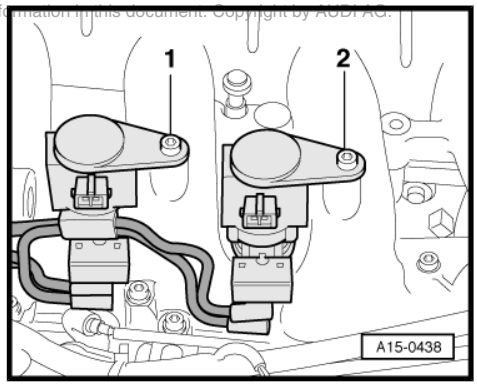


Note

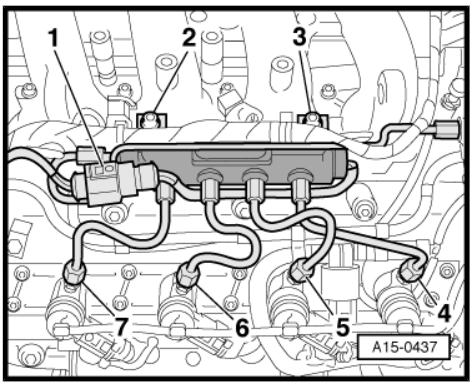
The distributor housing does not have to be completely removed.

– Screw out bolts -1- and -2-.

– Detach exhaust gas recirculation valve -N18- and exhaust gas recirculation valve 2 -N213- with vacuum pipes.
– Unplug connector -1- at rail element for right cylinder bank (cylinder bank 1).



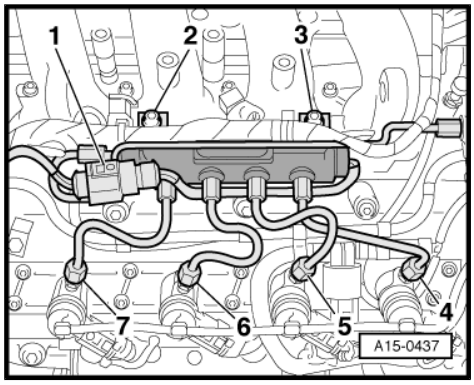
– Unscrew union nuts -4 - 7-.



Note

Provide support at connection when unfastening and tightening injector pipes at injectors.

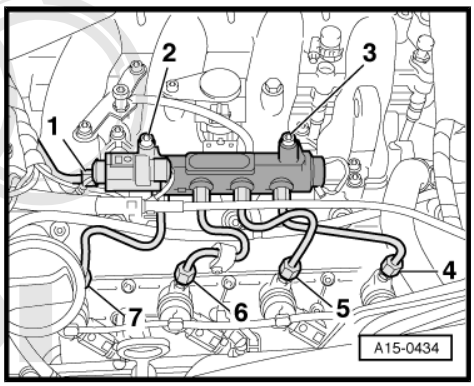
– Screw out bolts -2- and -3-.
– Take out rail element.
– Unplug connectors from glow plugs.
– Unscrew union nut -1- at rail element for left cylinder bank (cylinder bank 2).



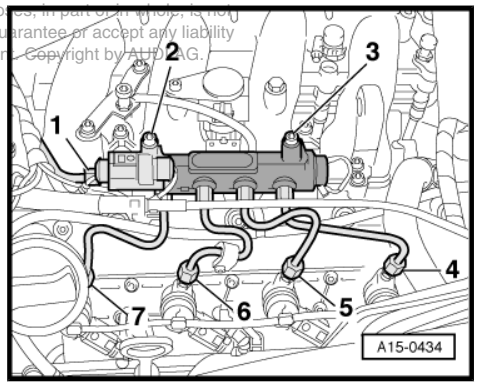
– Unscrew union nuts -4 - 7-.

Note

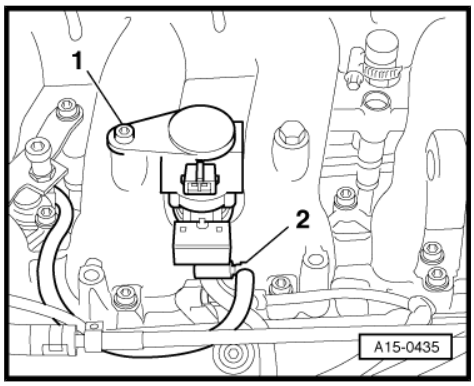
Provide support at connection when unfastening and tightening injector pipes at injectors.



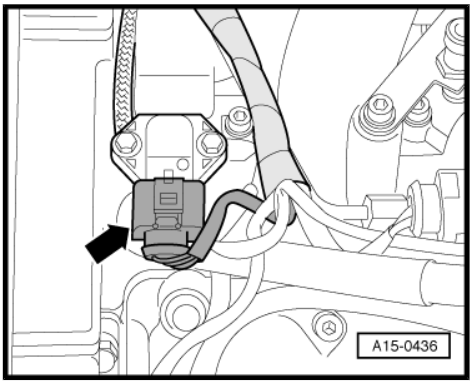
– Screw out bolts -2- and -3-.
– If necessary, unplug connector at holder to permit removal of rail element.
– Unscrew variable intake manifold flap changeover valve -N239- -1-.



– Detach vacuum hose -2- at angular section.
– Lay variable intake manifold flap changeover valve -N239- aside.



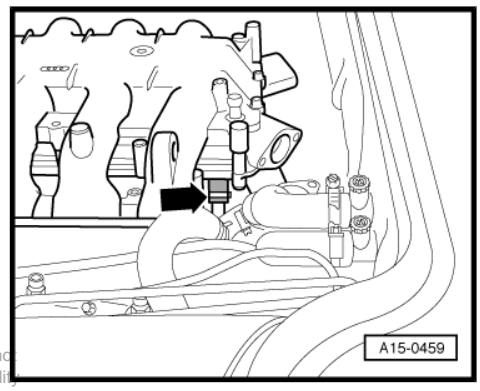
– Unplug connector at intake manifold pressure sender -G71- -arrow-.



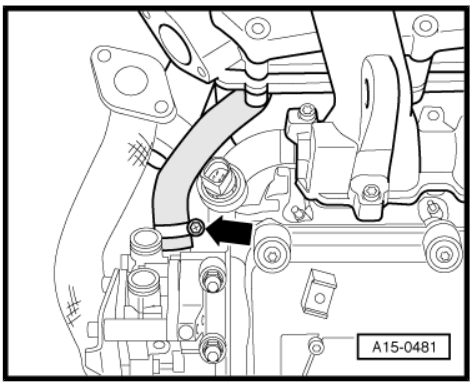
– If necessary, sever coolant hose -arrow- between intake manifold and coolant pipe on left.

Note

Hose clamp is not accessible with intake manifold in position.



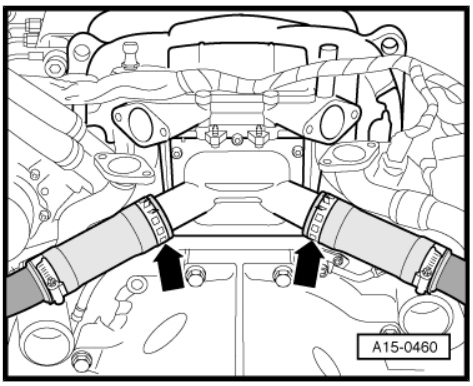
– Unfasten coolant hose -arrow- to intake manifold at rear right.



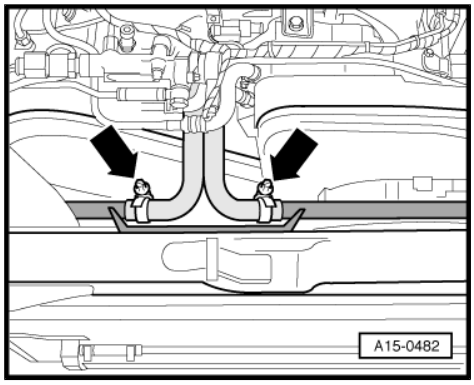
– Unfasten upper clamps of connecting hoses -arrow-.

Note

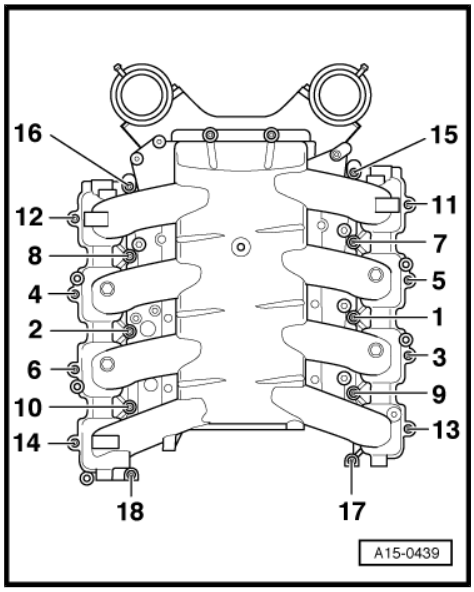
The engine has been removed in the illustration.



– Detach coolant hoses -arrow-.



– Screw out intake manifold bolts in reverse sequence -1 - 18-.
– Lift intake manifold off dowel sleeves.



Note

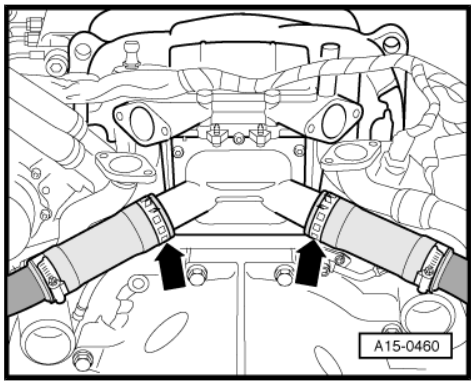
- *Pay attention to dowel sleeves when detaching intake manifold.*
- *Seal off intake ports in cylinder head with a clean rag.*
- *Detach intake manifold from connecting hoses.*
- *Guide out intake manifold beneath harness.*

Installing

Install in reverse order; paying attention to the following:

– Make sure all dowel sleeves are fitted before installing intake manifold.
– Replace all gaskets and seals.
– Before fitting intake manifold, attach coolant hose at rear left with both hose clamps.

– On insertion, push intake manifold onto connecting hoses -arrows-.

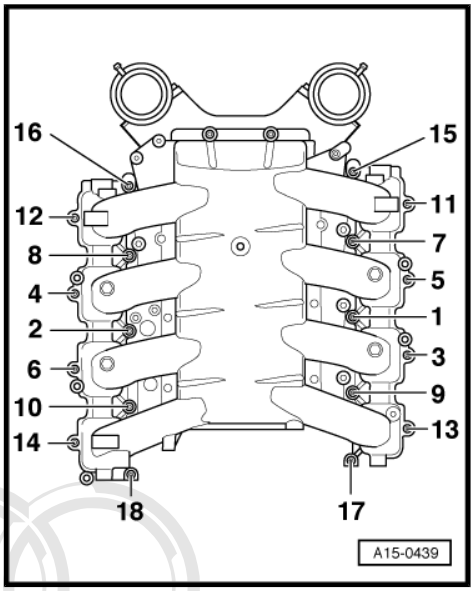


– Make sure shorter bolt M6 x 30 mm is fitted at front left of intake manifold.
– Hose connections and hoses must be free of oil and grease before fitting.

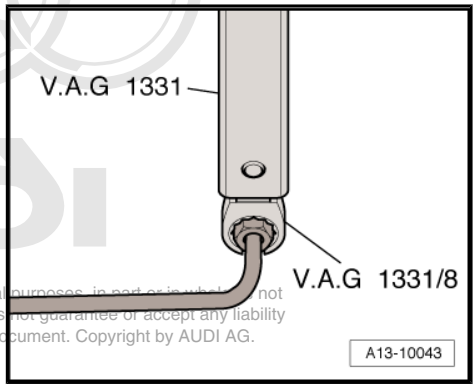
– Tighten intake manifold in two stages in sequence shown.

♦ 1. stage: Tighten bolts 1 - 18 to 5 Nm

♦ 2. stage: Tighten bolts 1 - 18 to 10 Nm



– Use -V.A.G 1331;Drehmomentschlüssel- with 14 mm open ring attachment -V.A.G 1331/8- to secure injector pipes.

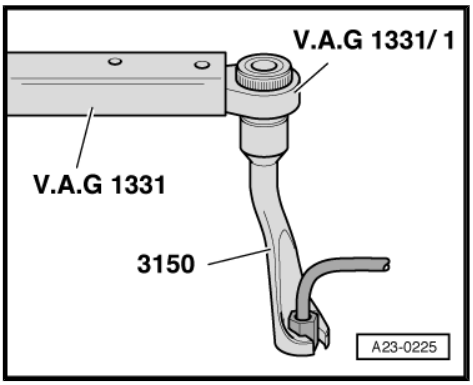


– Alternatively, use can be made of -V.A.G 1331;Drehmomentschlüssel- with -V.A.G 1331/1;Knarre- and 14 mm socket wrench -3150-

– All cable ties unfastened or severed on removal must be re-attached in the same position on installation.

– Re-install air pipe ⇒ page 62 .

– Fill system with coolant ⇒ Rep. Gr. 19 .



Tightening torques:

Component	Nm
Intake manifold to cylinder head (tighten in two stages)	1. stage 5 2. stage 10
Distributor housing to intake manifold	10
Rail element to intake manifold	22
Injector pipes	25
Retaining bracket to high-pressure pump and intake manifold	22
Solenoid valves to intake manifold	10
Clamps for coolant hoses	2
Clamps for air hoses	3,5

1.10 Removing and installing rear air pipe

Note

- *In the following, removal of the air pipe is described with the engine in position. Certain operations are not necessary if the engine has been removed.*
- *Re-attach all cable ties in the same locations on installation.*

Removing

Engine in position

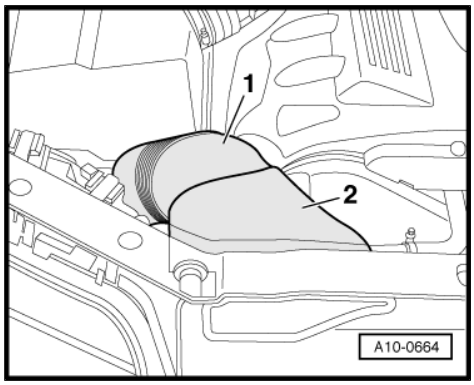
– Carefully detach engine cover from retaining pins ⇒ page 66 .

•

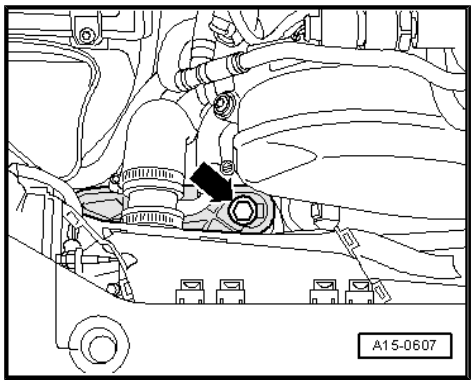
– Detach engine cover -arrows-.

– Unclip cover -2- for air duct at lock carrier.

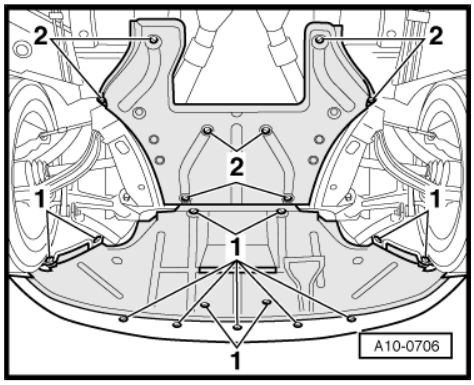
– Remove air duct -1-.



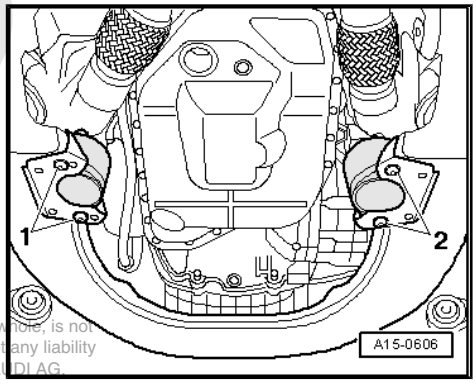
– Slacken off bolt -arrow- for torque reaction support by 6 turns.



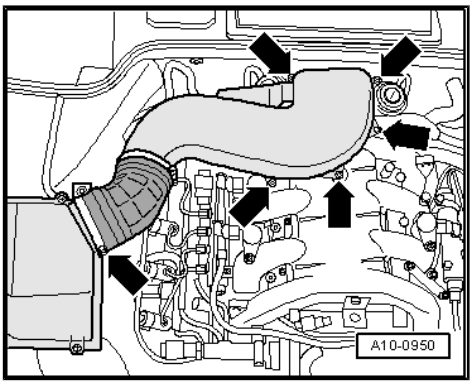
– Unfasten quick-release fasteners -2- and detach rear noise insulation.



– Screw out bolts -1- and -2- for gearbox mountings on left and right.



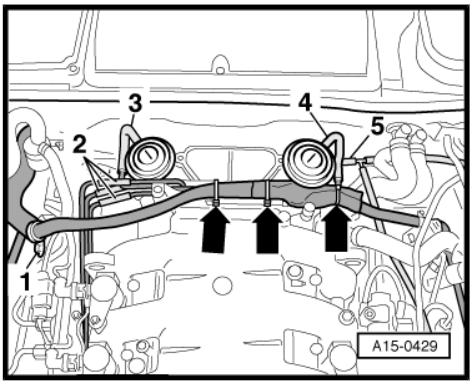
– Remove top air pipe with air hose -arrows-.



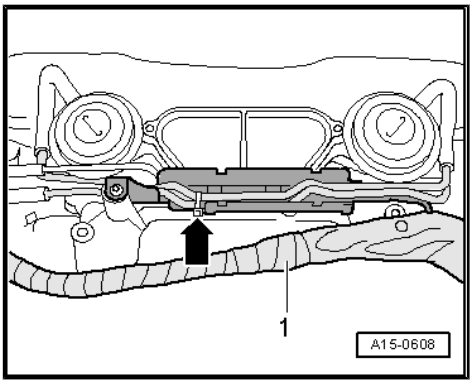
Note

Seal off inlet connections with clean cloths.

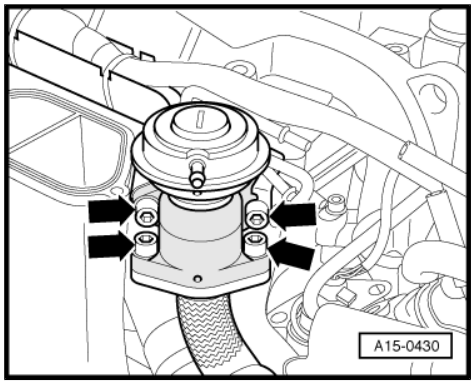
– Unscrew clamp -1-.
– Mark vacuum hoses -2- prior to disconnection.
– Detach vacuum hoses -2 ... 5-.
– Sever cable ties -arrows-.



– Set down wiring harness -1- to front.
– Sever cable tie -arrow- in holder.



– Screw out bolts -arrows- at mechanical exhaust gas recirculation valves on both sides.



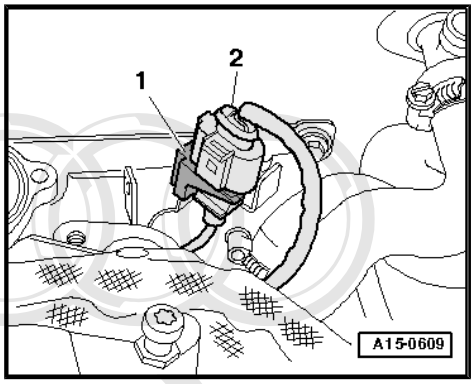
Note

Fig. shows right exhaust gas recirculation valve with engine removed.

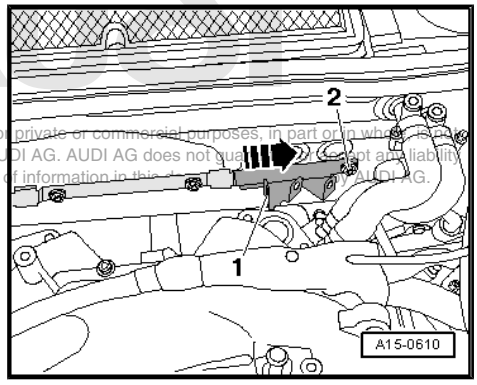
– Detach vacuum pipes, holder and both mechanical exhaust gas recirculation valves.

– Unplug connector -2- for engine speed sender -G28- .

– Unclip bottom part of connector with holder -1- from mounting rail.



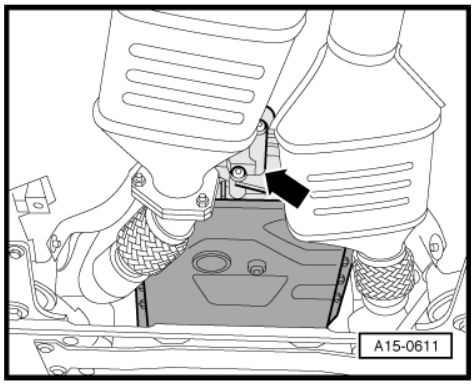
– Unscrew nut -2- and detach left part of mounting rail -1- in -direction of arrow-.



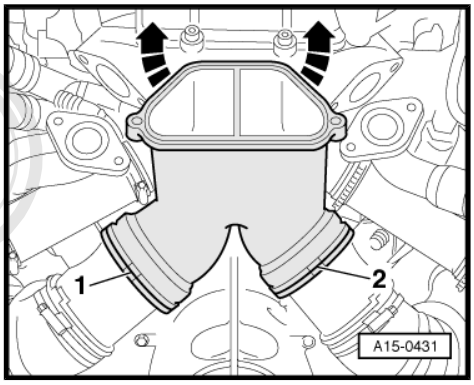
– Use lifting platform to raise vehicle approx. 20 cm.

– Place a suitable wooden block on a trolley jack and position this behind the ATF pan at the point marked with an -arrow- on the gearbox housing.

– Use the trolley jack to raise the automatic gearbox slightly until the engine tilts forward somewhat, thus providing access to the bulkhead.



– Pull out retaining clips -1- and -2- approx. 10 mm.
– Detach rear air pipe first from left and then from right air mass meter.
– Guide out rear air pipe upwards -arrows-.



Note

Fig. shows back of engine removed.

Installing

Install in reverse order; paying attention to the following:

Note

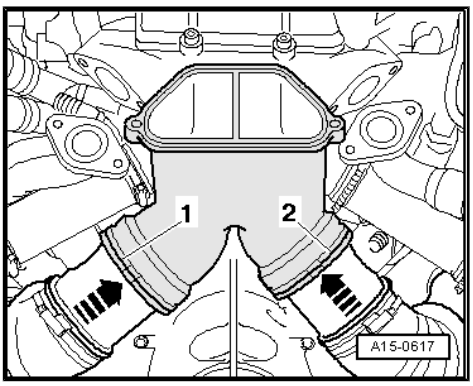
- *Replace gaskets and seals.*
- *Re-attach all cable ties unfastened or severed on removal at the same location on installation.*
- *Secure all hose connections with standard clamps ⇒ Parts catalogue .*
- *Hose connections and hoses must be free of oil and grease before fitting.*

– Coat O-rings in rear air pipe with fuel.

Note

Do not use silicone spray or silicone-based lubricants, as the silicone could damage the air mass meters.

– Pull out retaining clips -1- and -2- approx. 10 mm.
– Press left and then right air mass meter into rear air pipe -arrows-.
– Engage air mass meters with retaining clips.
– Check firm attachment of air mass meters in air pipe.
– Engage rear air pipe at intake manifold.
– Install left and right gearbox mountings.



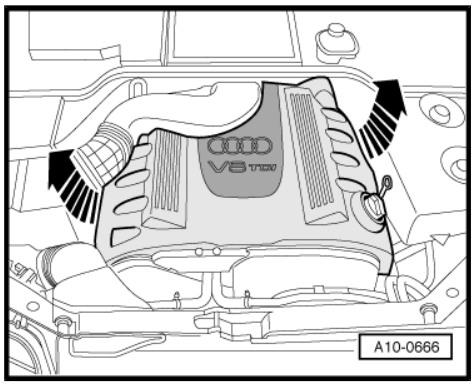
Tightening torques

Component		Nm
Mechanical exhaust gas recirculation valve to intake manifold or connecting pipe		22
Top air pipe to	Rear air pipe	10
	Cylinder head	10
Torque reaction support to longitudinal member		40
Gearbox mounting to subframe		40
Clamps for air hoses		3,5

1.11 Removing and installing engine cover

Removing

– Carefully detach engine cover from retaining pins -arrows-. Do not pull off cover abruptly or on one side only.



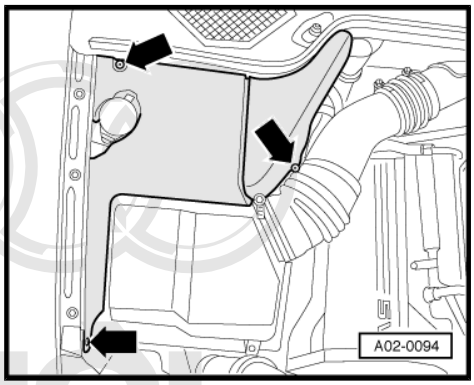
Installing

– To avoid damage, do not strike engine cover with fist or tool.
– Position engine cover on engine (pay attention to oil filler neck).
– Press engine cover with both hands onto retaining pins.

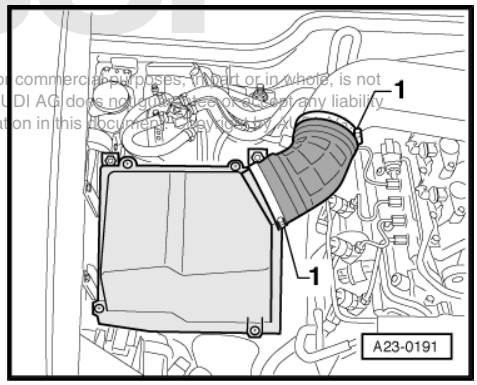
1.12 Removing and installing air cleaner (cleaning air intake duct)

Removing

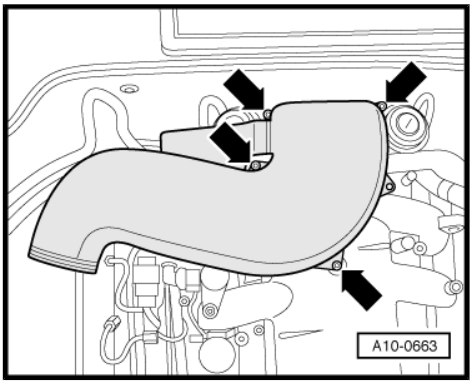
– Remove engine cover ⇒ page 66 .
– Remove cover on right in engine compartment -arrows-.



– Unfasten hose clamp -1-.
– Remove top part of air cleaner housing.
– Pull out old air filter element.



– Remove top air pipe -arrows-.



Installing

To ensure proper operation of the air mass meters it is essential to comply with the following.

Note

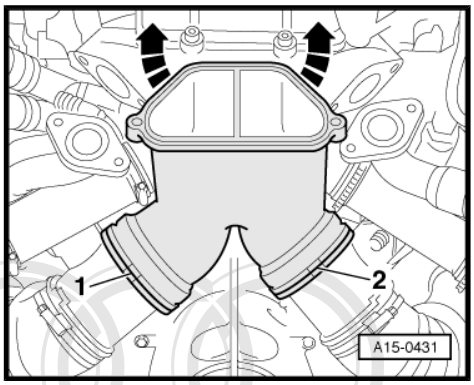
- *If the air filter element is severely contaminated or soaked, dirt particles or moisture could ingress as far as the air mass meters and bias the measured air mass value. This would lead to a loss of power on account of a smaller injection quantity being calculated.*
- *Always use a genuine air filter element.*
- *There must not be any contamination of the entire intake duct as far as the air mass meters.*
- *Use a silicone-free lubricant when installing the intake hose.*
- *Secure all hose connections with standard clamps ⇒ Parts catalogue .*

– Blow out water drain in bottom part of air cleaner housing with compressed air.

– Remove grit, dirt and leaves from top and bottom part of air cleaner housing using a vacuum cleaner if necessary.

– Check for grit, dirt and leaves in air mass meter and intake hose (clean air end).

– Check for contamination of intake duct as far as air filter element.



– Re-install air pipe.

– Tightening torque: 10 Nm

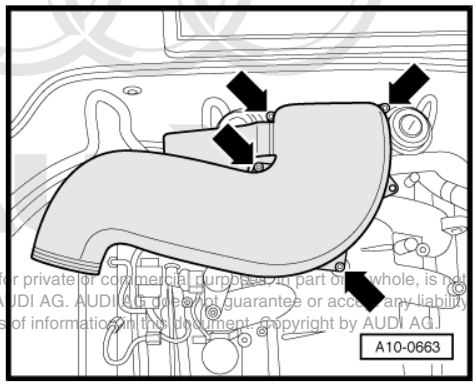
– When installing the air filter element, make sure it is centred in the mount in the bottom part of the air cleaner.

– Position the top part of the air cleaner carefully on the bottom part, without exerting force. In doing so, make sure the top part of the air cleaner is not at an angle on the air filter element. Pay attention to sealing lip of air filter element (unmetered air).

– Then screw top part of air cleaner to bottom part.

– Secure hose clamp.

– Re-install cover on right in engine compartment as well as engine cover.



1.13 Wiring and component check with test box -V.A.G 1598/30;Adapter-

Note

- *If the engine control unit is bolted to a protective housing, the housing must be separated from the engine control unit for connection of the test box. Procedure ⇒ page 70 . After completing repair work, the protective housing must always be re-attached to the engine control unit.*
- *Use is to be made for checking of the -V.A.G 1526B;Hand-multimeter- or the -V.A.G 1715;Multimeter- and the diode test lamp -V.A.G 1527- .*
- *For connecting the testers to the test box -V.A.G 1598/30;Adapter- , use is always to be made of test leads from -V.A.G 1594C;Messhilfsmittel-Set- .*
- *Unplugging the connectors of the engine control unit erases the adaption values. The content of the fault memory is retained.*

WARNING

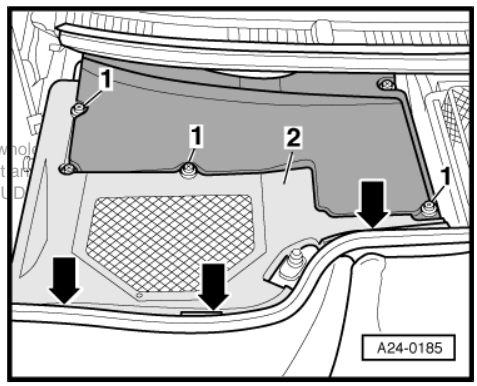
To avoid damaging electronic components, select the appropriate measuring range before connecting the test leads and heed the test conditions.

Connecting test box -V.A.G 1598/30;Adapter-

– Slacken off cross-head bolts -1- at electronics box in plenum chamber.

– Unclip plenum chamber cover -2- at front at bulkhead -arrows-.

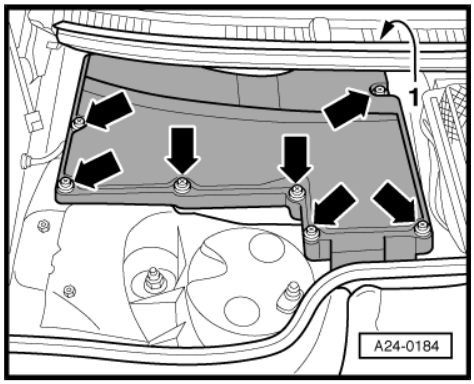
– Detach plenum chamber cover.



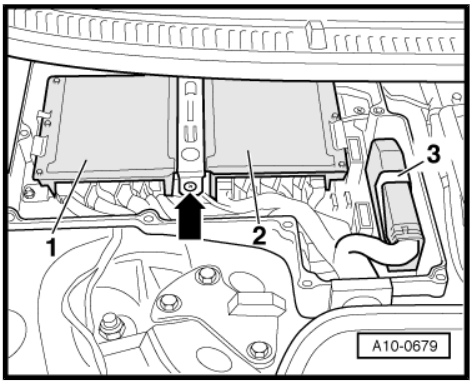
– Prise out cover -1- in scuttle panel trim and slacken off rear cross-head bolt -arrow- at rear right.

– Slacken off the remaining cross-head bolts -arrows-.

– Detach cover of electronics box in plenum chamber.



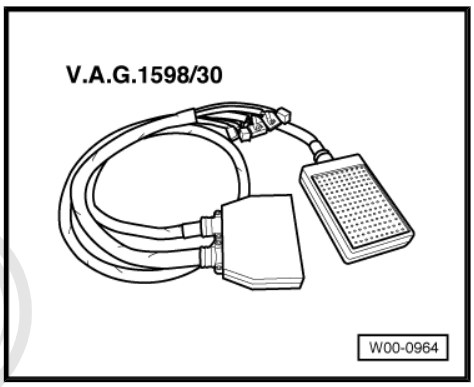
– Screw out bolt -arrow-.
– Disengage retainer.
– Remove diesel direct injection system control unit -J248- “Item 1” or diesel direct injection system control unit 2 -J494- “Item 2”.
– Release and unplug connectors of diesel direct injection system control unit -J248- or diesel direct injection system control unit 2 -J494- .



– Connect test box -V.A.G 1598/30;Adapter- to connector of appropriate wiring harness.
– Carry out test as described in appropriate repair procedures.

Perform the following after reconnecting engine control unit:

– Interrogate and, if necessary, erase fault memory. ⇒ Vehicle diagnostic, testing and information system VAS 5051



1.14 Replacing diesel direct injection system control unit -J248- (without protective housing)

The following procedure applies to engine control units which are not bolted to a protective housing.

Procedure with protective housing ⇒ page 70

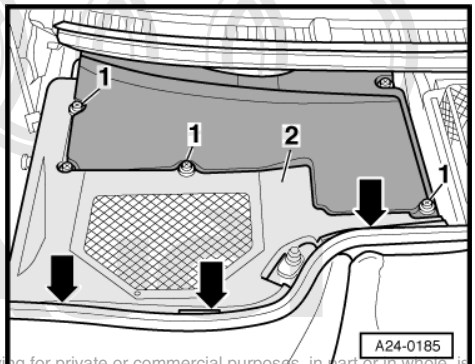
Removing

– Connect up fault reader and select vehicle system “01 - Engine electronics” from list. When doing this, the ignition must be switched on.

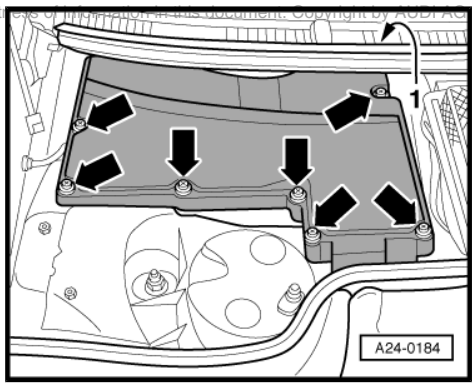
The control unit identification and the code -2- appear on the fault reader display.

– Always start by displaying and printing out the control unit identification.
– Switch off ignition.

– Slacken off cross-head bolts -1- at electronics box in plenum chamber.
– Unclip plenum chamber cover -2- at front at bulkhead -arrows-.
– Detach plenum chamber cover.



– Prise out cover -1- in scuttle panel trim and slacken off rear cross-head bolt -arrow- at rear right.
– Slacken off the remaining cross-head bolts -arrows-.
– Detach cover of electronics box in plenum chamber.



– Screw out bolt -arrow-.
– Disengage retainer.
– Release and unplug connectors of diesel direct injection system control unit -J248- “Item 1”.
– Take out old diesel direct injection system control unit -J248- “Item 1” and install new engine control unit.

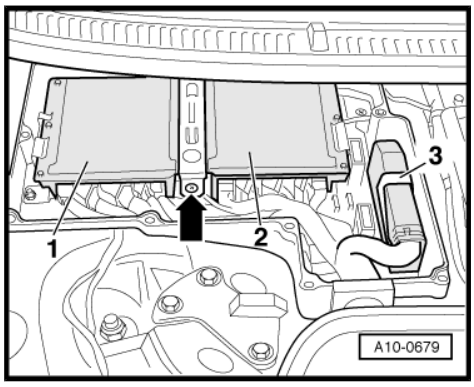
Installing

Install in reverse order; paying attention to the following:

The following steps must be performed after installing new engine control unit:

– Interrogate fault memory and erase if necessary.
– Encode new engine control unit ⇒ page 27 .
– On vehicles fitted with cruise control (can be seen from steering column switch), this must be activated in the engine control unit.
– Adapt immobilizer to engine control unit using the “Guided fault-finding” function:

• “Select correct vehicle”, press “Go to” key, then select “Function/component selection” menu, select “Control unit functions” from list, then select “Dash panel insert” and finally select “J218 combi processor, adaption to engine control unit (immobilizer)” from list.



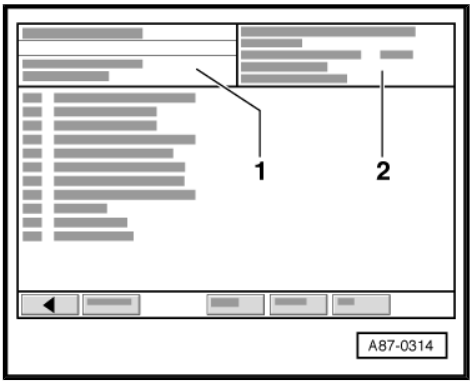
1.14.1 Procedure for engine control units bolted to a protective housing

Removing

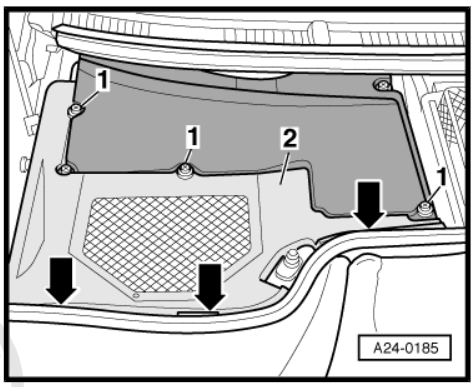
– Connect up fault reader and select vehicle system “01 - Engine electronics” from list. When doing this, the ignition must be switched on.

The control unit identification and the code -2- appear on the fault reader display.

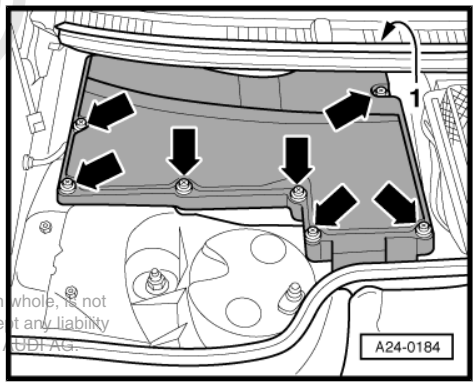
– Always start by displaying and printing out the control unit identification.



– Slacken off cross-head bolts -1- at electronics box in plenum chamber.
– Unclip plenum chamber cover -2- at front at bulkhead -arrows-.
– Detach plenum chamber cover.



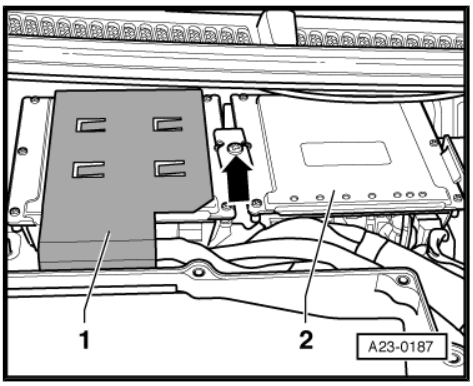
– Prise out cover -1- in scuttle panel trim and slacken off rear cross-head bolt -arrow- at rear right.
– Slacken off the remaining cross-head bolts -arrows-.
– Detach cover of electronics box in plenum chamber.



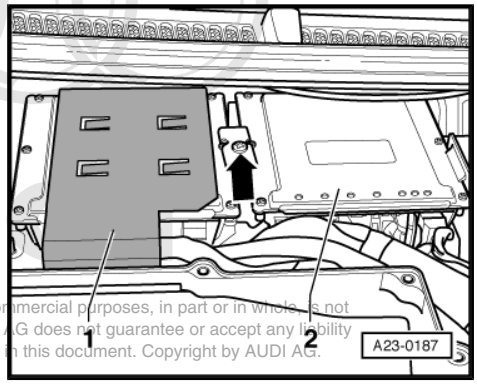
Fitting location of engine control units:

1 - Diesel direct injection system control unit -J248- (with protective housing)

2 - Diesel direct injection system control unit 2 -J494- (without protective housing)



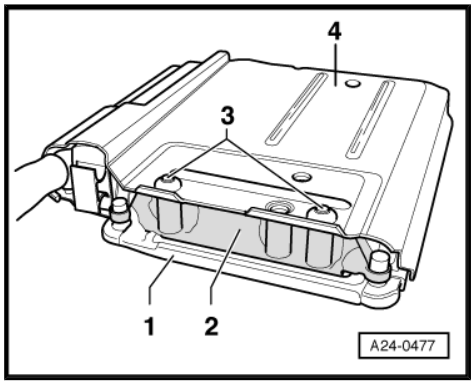
– Screw out bolt -arrow-.
– Detach securing clip.



To make the connectors at the engine control unit less accessible, the engine control unit -1- is bolted to a protective housing -4- by means of a locking element -2- and shear bolts -3-.

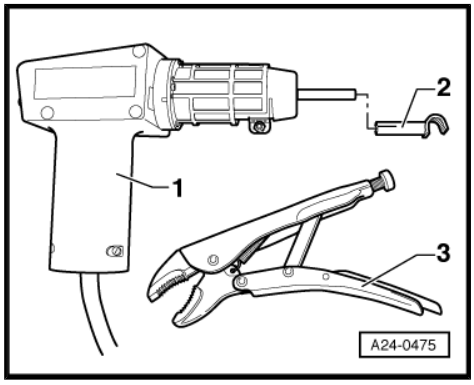
To make it even more difficult to screw out the shear bolts, the threads are coated with locking fluid.

The engine control unit must be separated from the protective housing to enable the connectors to be unplugged from the engine control unit (e.g. when connecting test box or replacing engine control unit). This procedure is described in the following.



Special tools and workshop equipment required

♦ Hot air blower -1- (from -VAS 1978;Leitungsstrang-Reparatur-Set-)



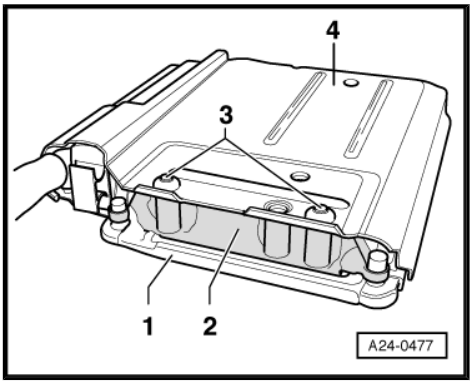
♦ Nozzle attachment -2- (also from -VAS 1978;Leitungsstrang-Reparatur-Set-)

♦ Commercially available vice-grip pliers

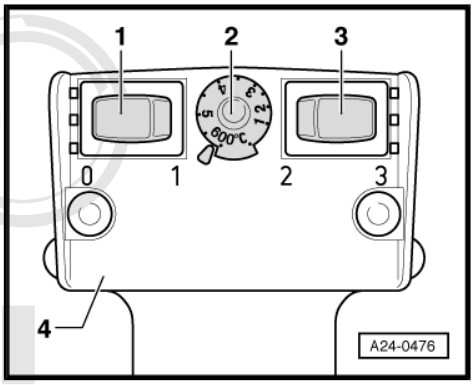
WARNING

Exact compliance with the following operations is essential so as not to damage (scorch) wiring, connectors, insulation and control units. Observe operating instructions for hot air blower.

– “Fold” diesel direct injection system control unit -J248- with protective housing towards engine compartment so that locking element (Item -2- in Fig.) becomes visible. Place a clean cloth beneath the engine control unit.



– Select settings on hot air blower as shown in illustration, i.e. set temperature potentiometer -2- to maximum heat output and two-stage air flow switch -3- to position 3.



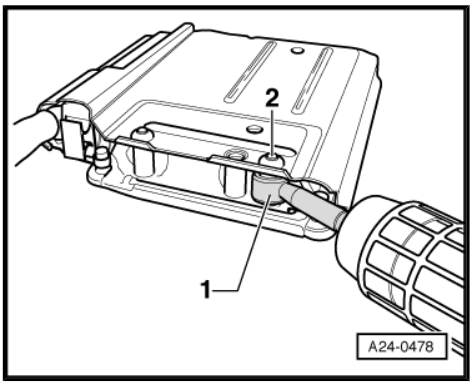
Note

Then use hot air blower to heat thread of locking element, into which shear bolts are screwed. This step reduces the inhibiting action of the locking fluid on the shear bolt threads, making these easier to unscrew.

WARNING

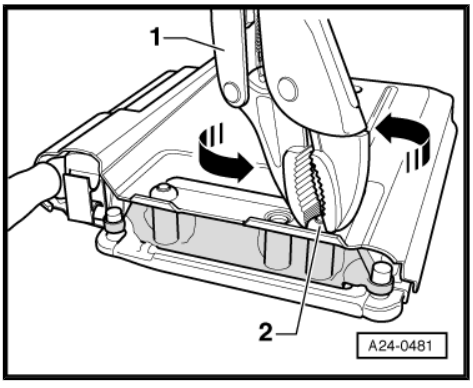
The shear bolts and parts of the protective housing also become very hot when heating the threads of the locking element. Take care to avoid burns. It is also important to ensure that only the thread is heated and none of the surrounding components if at all possible. These should be covered if necessary.

– Position the nozzle -1- of the hot air blower such that it “surrounds” the thread of the locking element. Allow nozzle to rest on upper end of protective housing.
– Switch on hot air blower and heat thread for about 20 to 25 seconds.



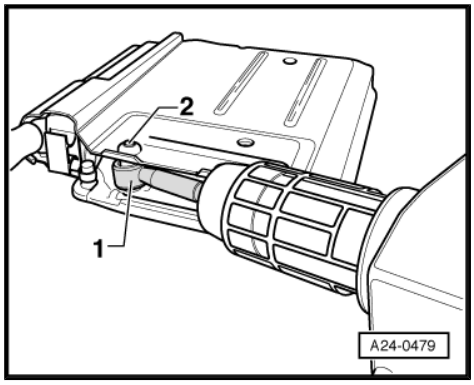
– Then grasp head of bolt -2- with vice-grip pliers -1- and unscrew shear bolt in direction of arrow.

The procedure for the second shear bolt is exactly the same. Particular care is to be taken in this case as the control unit connectors are in the immediate vicinity.

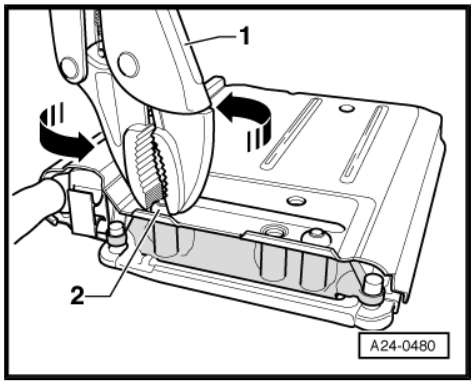


– Position nozzle -1- of hot air blower such that the nozzle again “surrounds” the thread of the locking element. Allow nozzle to rest on upper end of protective housing.

– Switch on hot air blower and heat thread for about 20 to 25 seconds.



– Then grasp head of bolt -2- with vice-grip pliers -1- and unscrew shear bolt in direction of arrow.



Engine control unit can now be separated from protective housing.

– Release and unplug connectors of diesel direct injection system control unit -J248- .

– Take out old diesel direct injection system control unit -J248- and install new engine control unit.

Installing

Note

Installation is performed accordingly in the reverse sequence. After installation, the protective housing must be fitted on the engine control unit. Use new shear bolts when doing so.

The following steps must be performed after installing new engine control unit:

– Interrogate fault memory and erase if necessary.

– Encode new engine control unit ⇒ page 27 .

– On vehicles fitted with cruise control (can be seen from steering column switch), this must be activated in the engine control unit.

– Adapt immobilizer to engine control unit using the “Guided fault-finding” function:

• “Select correct vehicle”, press “Go to” key, then select “Function/component selection” menu, select “Control unit functions” from list, then select “Dash panel insert” and finally select “J218 combi processor, adaption to engine control unit (immobilizer)” from list.

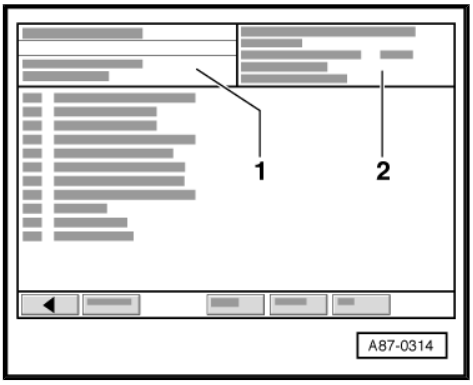
1.15 Replacing diesel direct injection system control unit 2 -J494-

Removing

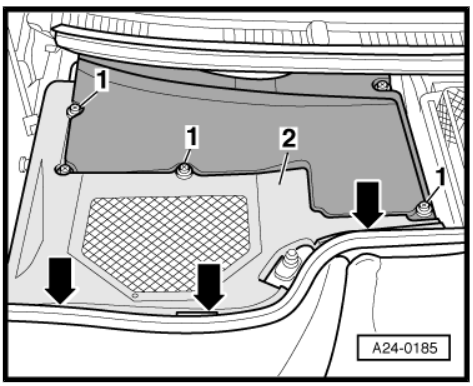
– Connect up fault reader and select vehicle system “11 - Engine electronics 2” from list. When doing this, the ignition must be switched on.

The control unit identification and the code -2- appear on the fault reader display.

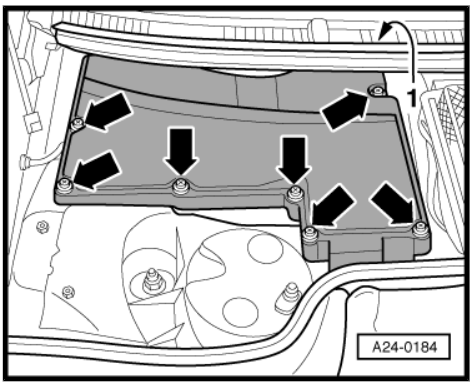
– Always start by displaying and printing out the control unit identification.



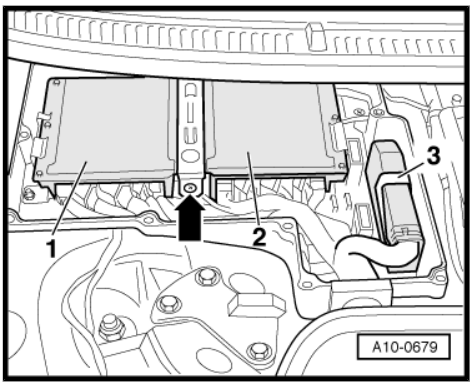
– Slacken off cross-head bolts -1- at electronics box in plenum chamber.
– Unclip plenum chamber cover -2- at front at bulkhead -arrows-.
– Detach plenum chamber cover.



– Prise out cover -1- in scuttle panel trim and slacken off rear cross-head bolt -arrow- at rear right.
– Slacken off the remaining cross-head bolts -arrows-.
– Detach cover of electronics box in plenum chamber.



– Screw out bolt -arrow-.
– Disengage retainer.
– Release and unplug connectors of diesel direct injection system control unit 2 -J494- “Item 2”.
– Take out old diesel direct injection system control unit 2 -J494- “Item 2” and install new engine control unit.



Installing

Install in reverse order; paying attention to the following:

– The immobilizer does “not” have to be adapted to diesel direct injection system control unit 2 -J494- .
– Interrogate fault memory and erase if necessary.
– Encode new engine control unit ⇒ page 27 .
– On vehicles fitted with cruise control (can be seen from steering column switch), this must be activated in the engine control unit.

1.16 Activating/deactivating cruise control system

Note

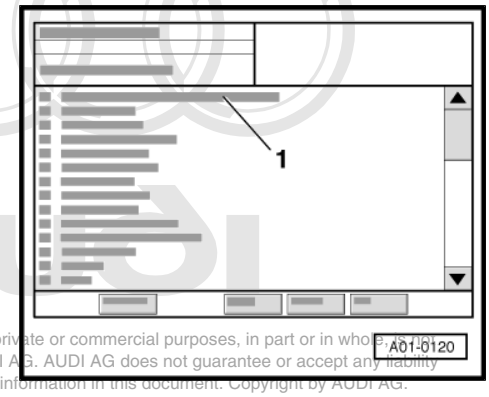
- *On vehicles fitted with CCS, the CCS function has to be re-activated following replacement of one or both engine control unit(s).*
- *An entry is made in the fault memory if the CCS function is activated in the engine control unit of a vehicle not fitted with CCS. In such cases the CCS function has to be deactivated.*

– Connect fault reader. When doing this, the ignition must be switched on.

Display:

– From list -1- select vehicle system “01 Engine electronics”.

– Wait until next display appears.

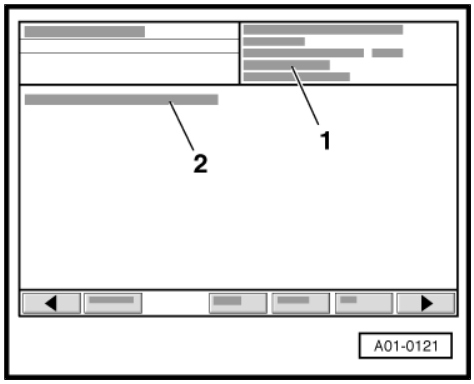


Display:

1 - Engine control unit identification

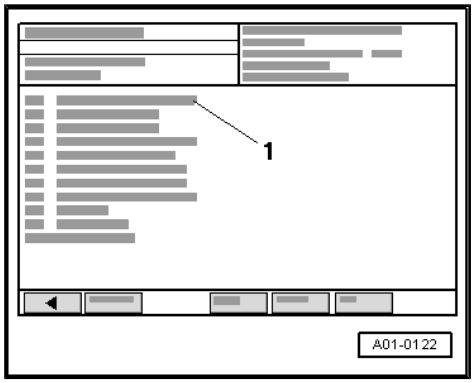
2 - Immobilizer control unit identification

– Touch > key.

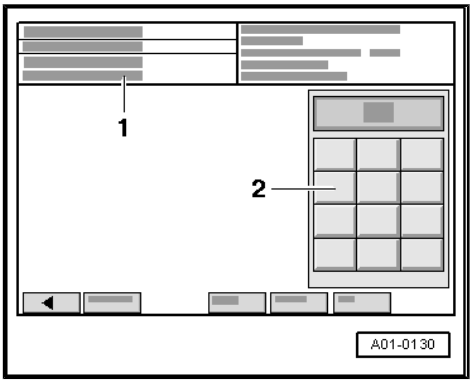


Display:

– From list -1- select diagnosis function “11 - Encoding II”.



Display:



1 - Enter code word

Activating CCS:

– Use keypad -2- to enter “11463” and confirm entry by touching Q key.

Deactivating CCS:

– Use keypad -2- to enter “16167” and confirm entry by touching Q key.

– Terminate function “11 - Encoding II” by touching ▾ key.

– Touch “06 - End output”.

– Switch off ignition.

1.17 Checking injectors

The injector is a solenoid-controlled injection unit.

– Connect fault reader and select engine electronics control unit 1 with “address word” 01. The engine must be idling when doing so.

– Select “Reading measured value block” function.

– Select “Display group number 13”.

Specification for cylinders 1 to 4: -2.49 mg/S...+2.48 mg/S (milligrammes per stroke)

– Select “Display group number 14”.

Specification for cylinders 5 to 8: -2.49 mg/S...+2.48 mg/S (milligrammes per stroke)

If one or more specifications is/are outside the tolerance in display group 13 or 14, check the corresponding injector ⇒ page 78 .

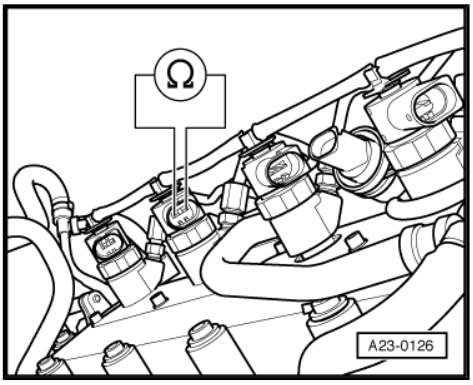
Note

- *The injection system features idling speed smooth running control. Differences in power between the individual cylinders (component tolerances, injector delivery, compression etc.) can be detected and compensation provided by way of selective injection quantity metering at idle.*
- *If the control unit detects a deviation, the cylinder concerned is immediately supplied with a higher or lower injection quantity until the engine is running "smoothly" again.*
- *+... mg/S: There is less power at the cylinder concerned and this is therefore supplied with more fuel.*
- *-... mg/S: There is more power at the cylinder concerned and this is therefore supplied with less fuel.*
- *Display groups 13 and 14 indicate the deviations in injection quantity for cylinder banks 1 and 2 respectively. If there is a considerable difference between the injection quantities for the two cylinder banks, check: Toothed belt tension, tensioning roller and timing. ⇒ 8-cyl. TDI engine, mechanics; Rep. Gr. 13; Crankshaft group*
- *If the value for one or more cylinders is +2.49 mg/S, it can be assumed that an injector is defective. The defective injector may influence other injectors preceding it in the firing order (1-5-4-8-6-3-7-2-). This means that even if the value for several injectors is +2.49 mg/S, only the last injector in the firing order is defective.*
- *The defective injector can also be established by accelerating slightly on reading out the measured values (maximum speed 1500 rpm). This causes all cylinders with the exception of one to consecutively depart from a value of +2.49 mg/S. The exception indicates the defective injector.*
- *If the vehicle has already been fitted with injectors with index H, only the defective injector is to be replaced. Otherwise, all 8 injectors are to be replaced, as the possibility of subsequent damage to the other injectors cannot be precluded.*
- *Electrical checking of injectors ⇒ page 78*
- *Removing and installing injectors ⇒ page 85*

1.17.1 Electrical checking of injectors

– Unplug connector at injector to be checked.

– Connect portable multimeter (resistance measuring range) to injector.



Specification at approx. 20 °C: 0.1...0.6 Ω

If reading does not match specification:

– Replace injector.

If reading matches specification:

– Check wiring between injectors and corresponding engine control unit.

Note

- *Diesel direct injection system control unit 2 -J494- actuates the injectors for cylinders 1, 2, 3, 4 of cylinder bank 1* *⇒ page 79* .
- *The diesel direct injection system control unit -J248- actuates the injectors for cylinders 5, 6, 7, 8 of cylinder bank 2* *⇒ page 80* .

1.17.2 Checking wiring connections of injectors 1, 2, 3, 4 of cylinder bank 1 to diesel direct injection system control unit 2 -J494-

– Switch off ignition.

– Unplug connector at injector to be checked.

– Connect test box -V.A.G 1598/30- to wiring harness to diesel direct injection system control unit 2 -J494- ⇒ page 68 .

Check the following wiring for short to positive or earth and open circuit.

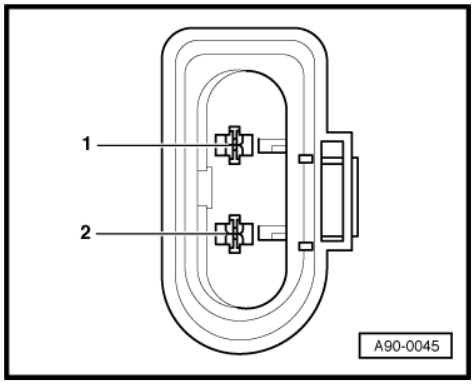
Cylinder	2-pin connector at wiring harness, contact	Test box - V.A.G 1598/30- , socket
1	1 2	5/02 5/05
2	1 2	5/01 5/09

Cylinder	2-pin connector at wiring harness, contact	Test box - V.A.G 1598/30- , socket
3	1 2	5/04 5/07
4	1 2	5/01 5/03

Resistance: max. 1.5 ohms

– Eliminate open circuit in wiring or short circuit if necessary.
⇒ Current flow diagrams, Electrical fault finding and Fitting locations

If no faults are found in the wiring and there are no electrical problems with the injectors, replace diesel direct injection system control unit 2 -J494- ⇒ page 74 .



1.17.3 Checking wiring connections of injectors 5, 6, 7, 8 of cylinder bank 2 to diesel direct injection system control unit -J248-

– Connect test box -V.A.G 1598/30- to wiring harness to diesel direct injection system control unit -J248- ⇒ page 68 .

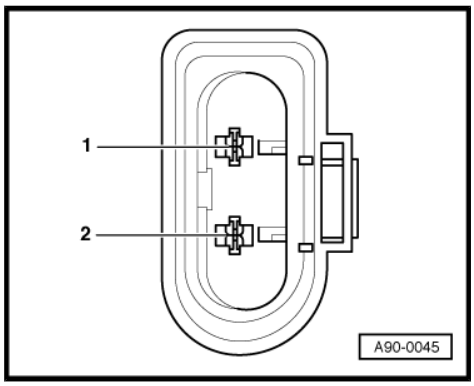
Check the following wiring for short to positive or earth and open circuit.

Cylinder	2-pin connector at wiring harness, contact	Test box - V.A.G 1598/30- , socket
5	1 2	5/0 5/05
6	1 2	5/04 5/07
7	1 2	5/01 5/09
8	1 2	5/01 5/03

Resistance: max. 1.5 ohms

– Eliminate open circuit in wiring or short circuit if necessary.
⇒ Current flow diagrams, Electrical fault finding and Fitting locations

If no faults are found in the wiring and there are no electrical problems with the injectors, replace diesel direct injection system control unit -J248- ⇒ page 69 .



1.18 Checking operation of injectors

In the event of a fault entry, poor throttle response, jolting on acceleration, lack of power, misfiring or failure to start, perform analysis for injectors sticking open or terminating delivery.

There are 2 injector testing options.

- Checking return flow rate of injectors ⇒ page 81
- Checking for injectors sticking open ⇒ page 83 .

1.18.1 Checking return flow rate of injectors (cylinder bank 1)

Injectors terminating delivery means: Internal defect in injector and thus high injector return flow rate

Caution

Always read rules for cleanliness and instructions for working on fuel system *⇒ page 47* *.*

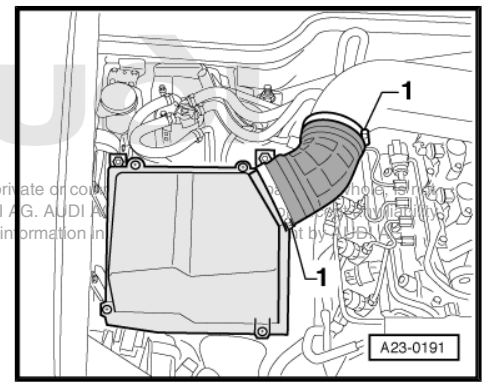
Follow these instructions before starting work and while working on the fuel system.

Special tools and workshop equipment required

- -V.A.G 1348/2B;Messgerät-
- -3094;Schlauchklemmen bis Ø 25 mm-
- 4 hoses with return connections (approx. 90 cm long) must be improvised (possibly available from replacement parts stock)

– Detach engine cover.

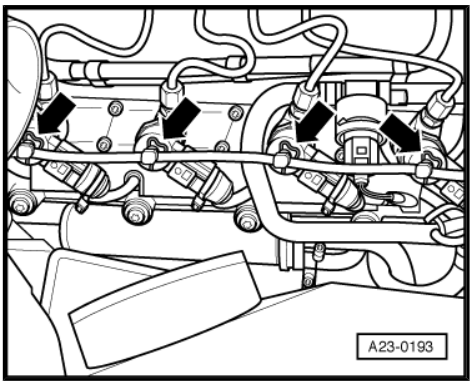
– Unfasten hose clamps -1- and remove air duct.



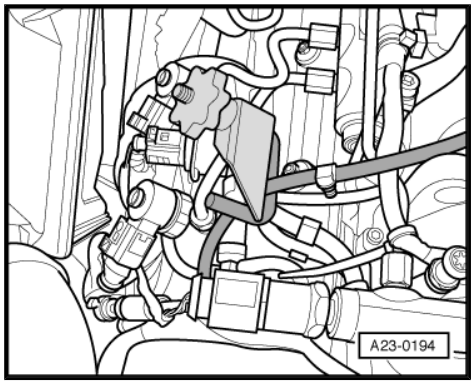
– Detach retaining clips -arrows- of return pipes.

– Detach return pipes at all four injectors and attach four hoses (approx. 90 cm long) to return connections.

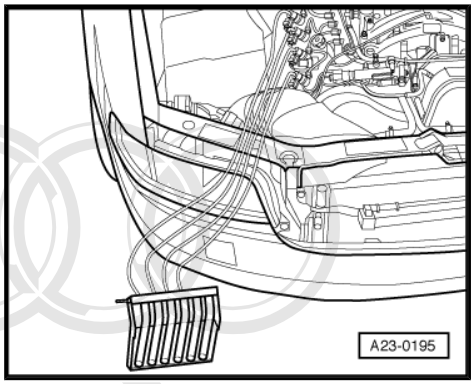
– Secure hoses with retaining clips again.



– The return manifold between cylinder 1 and the fuel temperature sensor must be sealed off with -3094;Schlauchklemmen bis Ø 25 mm- to stop fuel escaping at the disconnected return pipes.



– Feed the four hoses into -V.A.G 1348/2B;Messgerät- .
– Start engine.
– If the return flow rate of one or more injectors is so high that the engine will not start or is very difficult to start, this already becomes apparent when operating the starter from the considerable difference in the extent to which the measuring tubes are filled.
– If the engine starts, there should only be a minimal difference between the return flow rates of all four return pipes with the engine warm and idling at about 650 rpm.



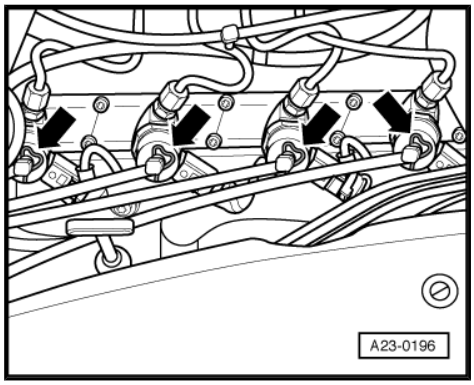
The return flow rate should not exceed 20 ml per minute at each cylinder.

If an injector does not meet this specification, replace the injector concerned ⇒ page 85 .

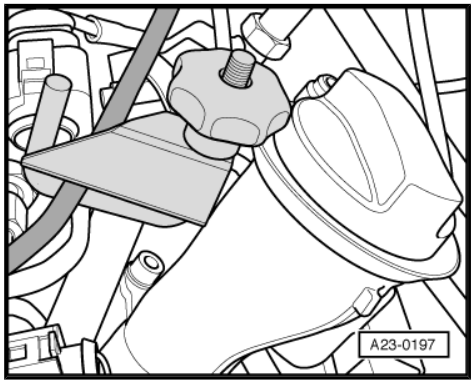
If specification is met, check cylinder bank 2 ⇒ page 82 .

1.18.2 Checking return flow rate of injectors (cylinder bank 2)

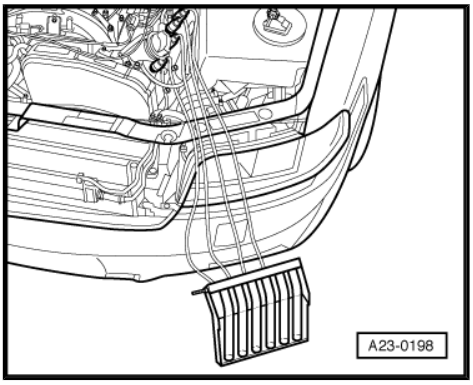
– Detach retaining clips of return pipes.
– Detach return pipes at all four injectors and attach four hoses (approx. 90 cm long) to return connections.
– Secure hoses with retaining clips again.



– The return manifold between cylinder 5 and the fuel temperature sensor must be sealed off with -3094;Schlauchklemmen bis Ø 25 mm- to stop fuel escaping at the disconnected return pipes.



– Feed the hoses into -V.A.G 1348/2B;Messgerät- .
– Start engine.
– If the return flow rate of one or more injectors is so high that the engine will not start or is very difficult to start, this already becomes apparent when operating the starter from the considerable difference in the extent to which the measuring tubes are filled.
– If the engine starts, there should only be a minimal difference between the return flow rates of all four return pipes with the engine warm and idling at about 650 rpm.



The return flow rate should not exceed 20 ml per minute at each cylinder.

If an injector does not meet this specification, replace the injector concerned ⇒ page 85 .

If the specifications are met for both cylinder banks, check whether injector is sticking open ⇒ page 83 .

Installing

– Press the return pipe connections carefully over the seal onto the injector. The seal must engage. Then secure the connections with retaining clips.

Bleeding fuel system and checking for leaks

– Run engine at idling speed for several minutes (do not press accelerator) and then switch off. Fuel system is bled automatically.
– Check the entire fuel system for leaks.

Replace the component concerned if a leak is found.

– Then perform a test drive, accelerating at least once to full load before checking the high-pressure section again for leaks.

Note

If there is still air in the fuel system, the engine may switch to emergency running mode during the test drive. Switch off the engine and erase the fault memory. Then continue with the test drive.

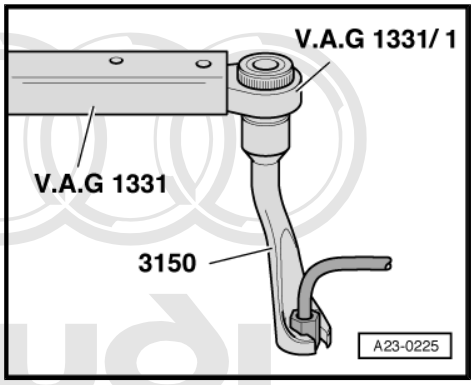
1.18.3 Checking for injectors sticking open

Injector sticking open means: The needle is not closing fully.

Special tools and workshop equipment required

♦ -T40040;Verschlussschraube-
♦ 14 mm socket wrench -3150-

♦ Torque wrench -V.A.G 1331- with ratchet -V.A.G 1331/1-



Note

The following test is described for cylinder No. 4 as an example. The test must be repeated for all rail element connections until the defective injector is located.

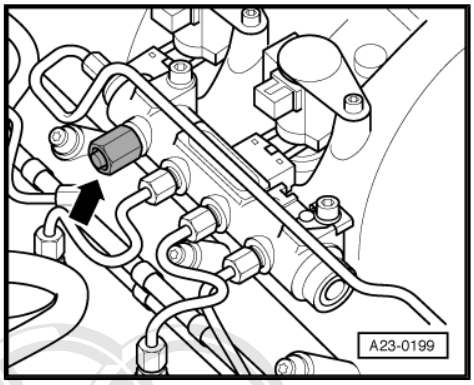
– Erase fault memory of engine control units.

– Use -3150;Steckschlüssel SW 14- to unscrew union nut at rail element (at cylinder 4 in example) as well as unscrewing union nut at injector.

– Seal off open rail connection with -T40040;Verschlusss-chraube- .

– Perform test drive.

– Read out fault memory on completion of test drive. If a fault relating to fuel pressure regulation has again been entered, repeat the operations with all injector connections until faults are no longer stored after test drive or until there are no further problems with engine running or starting.



Heed fitting instructions for all injector pipes.

– Blow out high-pressure pipes with compressed air before re-installing.

– Lubricate threads of union nuts with fuel.

– Hand-tighten union nuts. Take care to avoid strain.

– Then tighten union nuts to torque.

Component	Nm
High-pressure pipes between rail element and injector	25

Bleeding fuel system and checking for leaks

– Run engine at idling speed for several minutes (do not press accelerator) and then switch off. Fuel system is bled automatically.

– Check the entire fuel system for leaks.

Replace the component concerned if leakage still occurs despite correct tightening torque.

– Then perform a test drive, accelerating at least once to full load before checking the high-pressure section again for leaks.

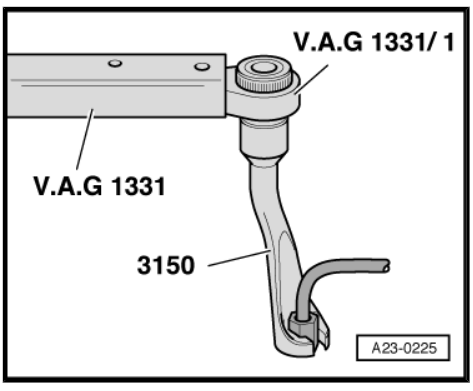
Note

If there is still air in the fuel system, the engine may switch to emergency running mode during the test drive. Switch off the engine and erase the fault memory. Then continue with the test drive.

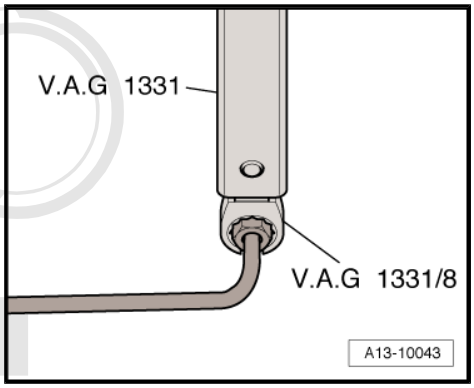
1.19 Removing and installing injectors

Special tools and workshop equipment required

- 14 mm socket wrench -3150-
- Torque wrench -V.A.G 1331- with ratchet -V.A.G 1331/1-



- 14 mm open ring attachment -V.A.G 1331/8-



- Puller -T40059-
- Multi-purpose tool -VW 771-

Removing

Caution

Always read rules for cleanliness and instructions for working on fuel system ⇒ page 47 .

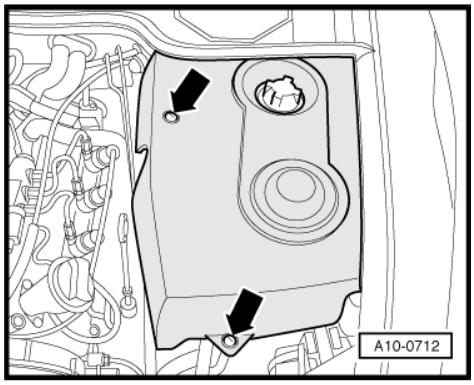
Follow these instructions before starting work and while working on the fuel system.

– Remove engine cover ⇒ page 66 .

– Pull lock carrier forwards ⇒ 8-cyl. TDI engine, mechanics; Rep. Gr. 13; Dismantling and assembling engine; Pulling lock carrier forwards

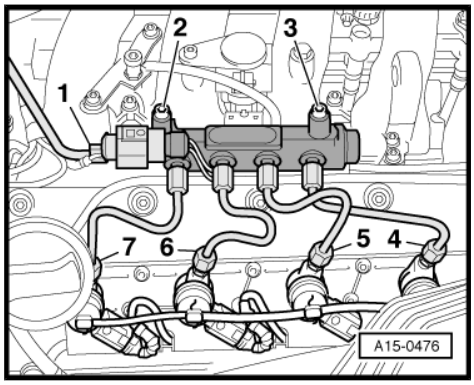
Left cylinder bank:

– Remove cover on left in engine compartment -arrows-.



– Unscrew union nut -1- at rail element using -3150;Steckschlüssel SW 14- .

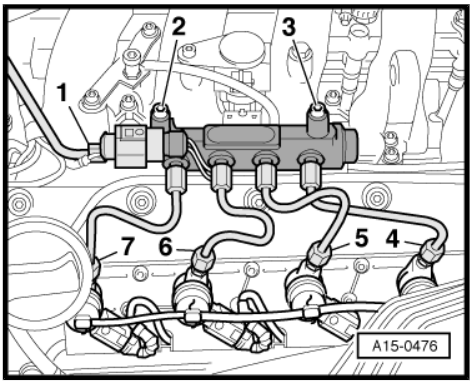
– Unscrew union nuts -4 ... 7- using -3150;Steckschlüssel SW 14- .



Note

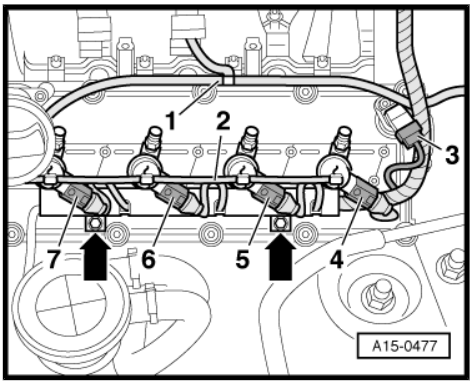
- *Provide support at inlet connector of injector when unfastening union nuts.*
- *Seal off open connections on pipes immediately with suitable caps.*

– Screw out bolts -2- and -3-.
– Carefully set down rail element on intake manifold.

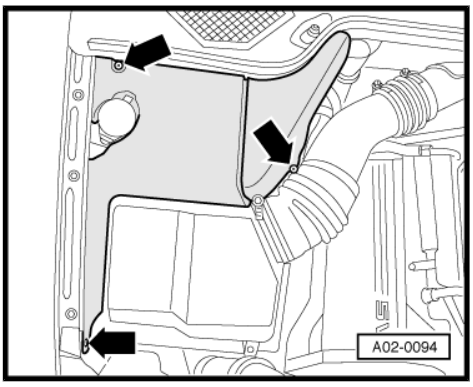


– Unplug connectors -3 ... 7-.
– Unscrew and lay bare wiring harness -arrows-.
– Detach retaining clips of return pipe -2-.
– Disconnect return pipe at injectors.

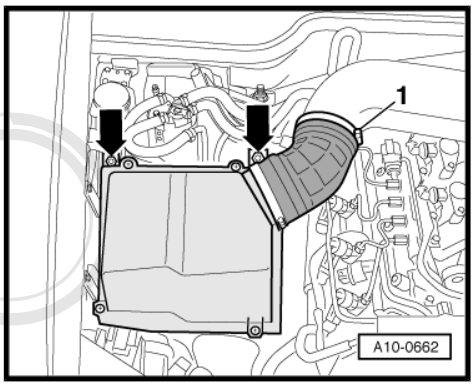
Right cylinder bank:



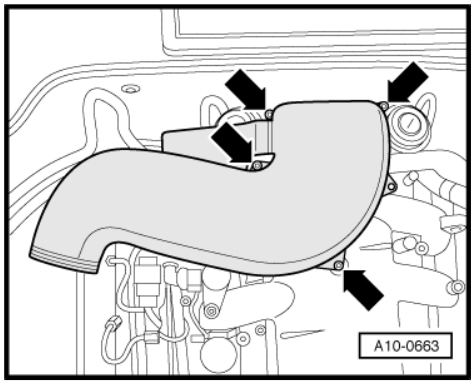
– Remove cover on right in engine compartment -arrows-.



– Unfasten hose clamp -1-.
– Remove air cleaner housing -arrows-.



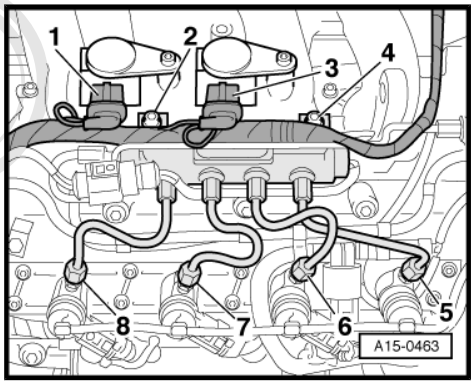
– Remove top air pipe -arrows-.



Note

Seal off inlet connections with clean cloths.

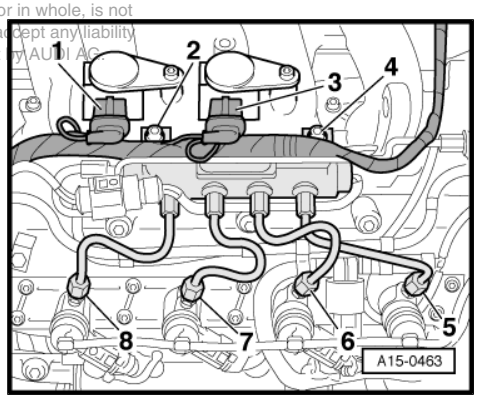
– Unplug connectors -1- and -3-.
– Unscrew union nuts -5 ... 8- using -3150;Steckschlüssel SW 14- .



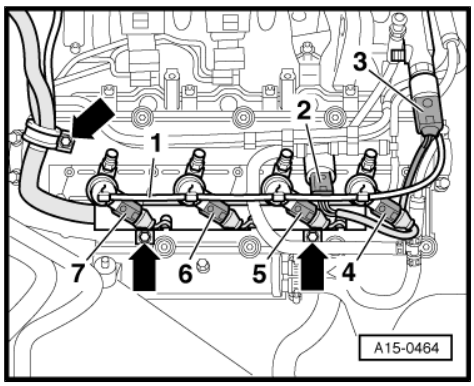
Note

- *Provide support at inlet connector of injector when unfastening union nuts.*
- *Seal off open connections on pipes immediately with suitable caps.*

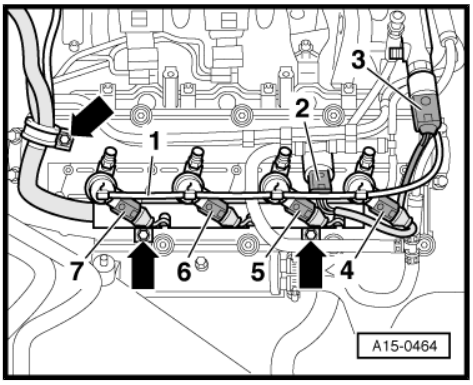
– Screw out bolts -2- and -4-.
– Unplug connectors from glow plugs.
– Carefully set down rail element on intake manifold.



– Unplug connectors -2 ... 7-.
– Unscrew and lay bare wiring harness -arrows-.



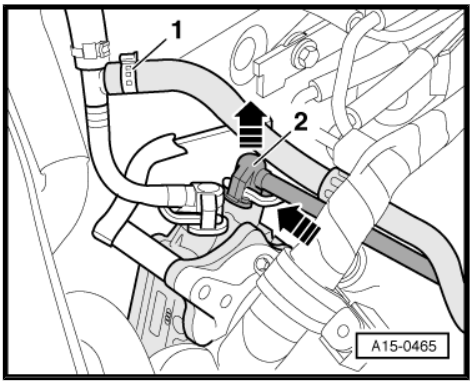
– Detach retaining clips of return pipe -1-.
– Disconnect return pipe at injectors.



– Disconnect fuel pipe -1- at T-piece.
– Disconnect fuel pipe -2- at fuel pre-supply pump. To do so, press catch and lift off pipe -arrows-.

Note

The catch must be pulled back again before connecting the fuel pipe.



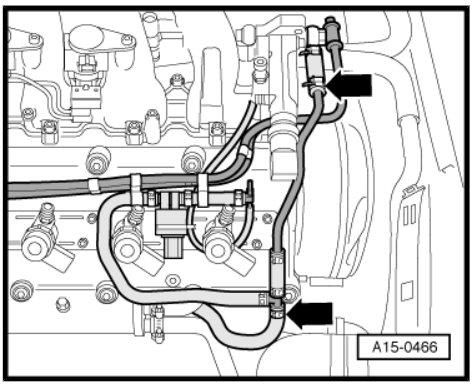
– Disconnect fuel pipes at points marked with arrows.
– Set down fuel pipes on intake manifold.

All models:

– Unscrew oil filler neck.

WARNING

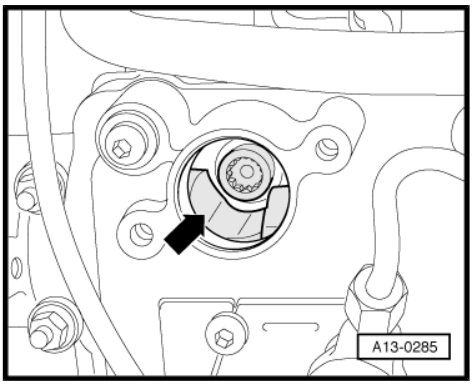
The engine is only to be turned at the crankshaft in the direction of engine rotation (clockwise).



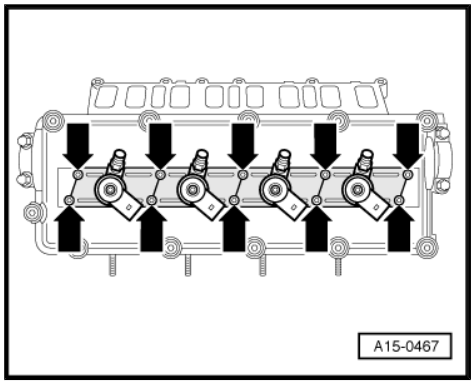
– Crank engine until bolt is visible through recess at camshaft -arrow-.

Note

- *The injectors can only be removed in certain camshaft positions.*
- *Crank engine at crankshaft central bolt.*

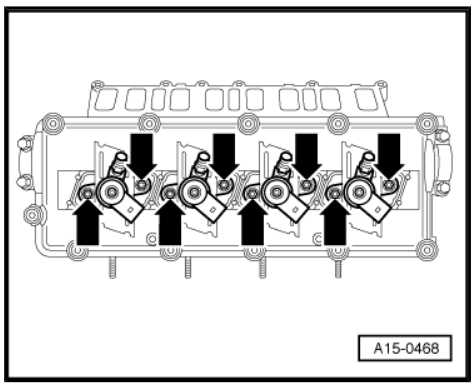


– Unscrew covers for injectors -arrows-.
– Pull covers upwards and give $^1/_4$ turn (90°).

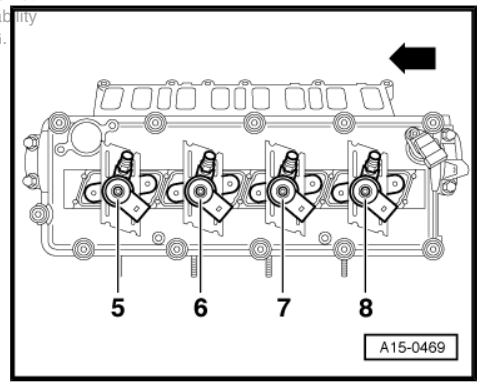


– Unscrew injectors -arrows-.

Left cylinder bank:



– Pull out injectors for cylinders 6 and 8.

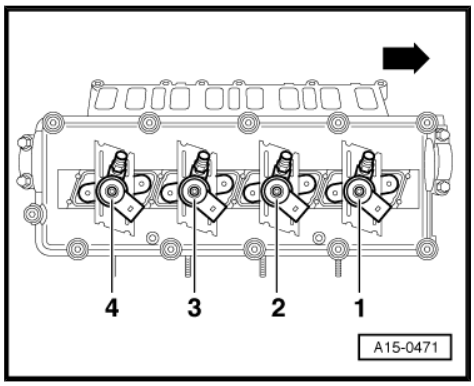


Note

Arrow points in direction of travel.

Right cylinder bank:

– Pull out injectors for cylinders 1 and 3.

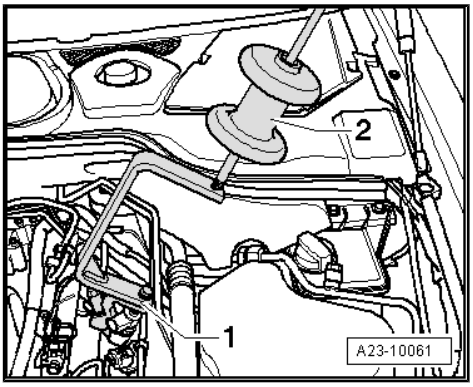


Note

Arrow points in direction of travel.

All models:

– Screw puller -T40059- -1- onto injector to be removed and knock out injector using multi-purpose tool -VW 771- -2-.

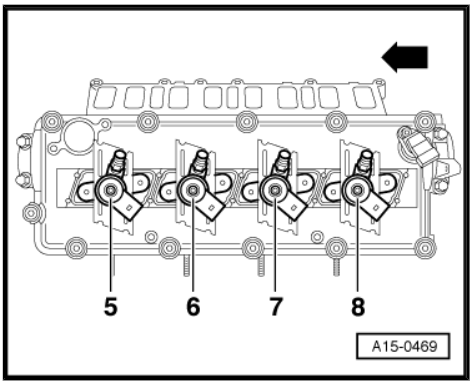


Note

– Give the crankshaft a further $^{1}/_{2}$ turn (180°) in clockwise direction.

Left cylinder bank:

– Pull out injectors for cylinders 5 and 7.

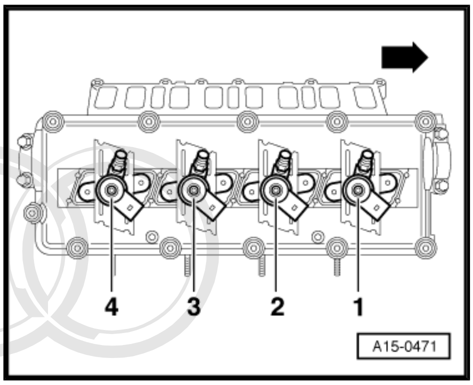


Note

Arrow points in direction of travel.

Right cylinder bank:

– Pull out injectors for cylinders 2 and 4.



Note

Arrow points in direction of travel.

Important instructions for installing injectors

- The following components are always to be replaced on removing and installing injectors: “Copper washer” “O-rings”
- The following components are always to be renewed on replacing injector: “Clamp” “Copper washer” “O-rings”
- Injectors removed are only to be re-installed at the same cylinder head in the same cylinder.
- Clean working area and tools before working on the injection system.
- On disassembly, immediately seal all open connections with suitable protective caps.
- Do not remove protective caps from any components until immediately prior to installation.
- Before fitting, visually inspect injectors and installation locations. Make sure the injector bores are clean. Wipe out if necessary using a clean cloth, taking care not to cause damage. Do not use sharp objects of any kind.
- Always use new seals and gaskets. Lubricate all gaskets and seals with assembly oil or clean engine oil before installing.
- The old copper seal is to be removed by fixing it loosely in position in a clamping tool and twisting and pulling the injector gently by hand out of the copper seal. Care is to be taken to avoid any damage to the injector.
- High-pressure pipes are never to be bent into shape and must be connected such that there is no strain.
- When working on any part of the high-pressure system, tools may only be used for securing and unfastening pipes. All other assembly and disassembly operations must be performed by hand without the use of any tools.
- Never fit return pipes without retaining clips.
- Press return pipes firmly by hand onto injectors from above until they are heard to engage at each injector. Then press in retaining clip. Pull return pipes upwards to check for firm attachment.
- All cable ties unfastened or severed on removal must be reattached in the same position on installation.

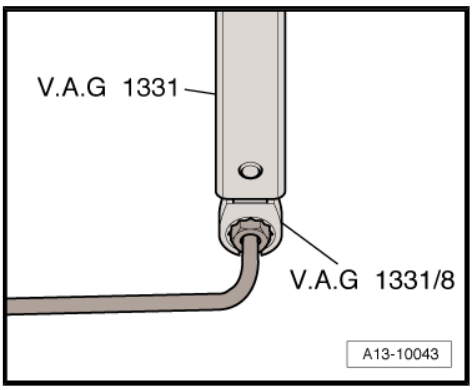
If a used injector is to be re-installed:

– Spray tip of injector with rust removal spray. Wait approx. 5 minutes and wipe off soot and oil particles with a cloth.

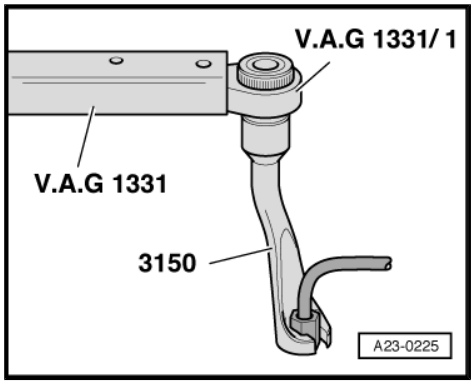
– If an injector is severely contaminated, additionally clean the tip with a soft brass brush to facilitate removal of the copper seal. Make sure the brush does not come into contact with the injector bores.

– To remove the old copper seal from the injector, clamp the seal carefully in a vice such that it is just prevented from turning between the jaws. Then carefully pull and twist the injector out of the copper seal by hand.

– Clean off deposits under the copper seal using a suitable scraper.
– Use a plastic bush to fit the new copper seal.
– To remove soot particles from the injector sealing surface, clean the injector bore in the cylinder head with a cloth soaked in engine oil or rust remover. Take care not to damage the sealing surface.
– Install injectors.
– Start by hand-tightening union nuts of high-pressure pipes and injector pipes.
– Ensure that high-pressure pipes and injector pipes are not subject to strain.
– Use -V.A.G 1331;Drehmomentschlüssel- with 14 mm open ring attachment -V.A.G 1331/8- to secure injector pipes.



– Alternatively, use can be made of -V.A.G 1331;Drehmoments-chlüssel- with -V.A.G 1331/1;Knarre- and 14 mm socket wrench -3150-



Tightening torques

Component	Nm
Injector to cylinder head	10
Cover for injector to cylinder head cover	5 8)
Oil filler neck to cylinder head	10
Rail element to intake manifold	22
Injector pipes	25

8) Replace bolts

– Install lock carrier ⇒ 8-cyl. TDI engine, mechanics; Rep. Gr. 13; Dismantling and assembling engine; Pulling lock carrier forwards

Bleeding fuel system and checking for leaks

– Run engine at idling speed for several minutes (do not press accelerator) and then switch off.

Note

The fuel system is self-bleeding; do not open the high-pressure connections.

– Switch off ignition.

– Carefully check entire fuel system and connections of return pipes (8x) for leaks.

Replace the component concerned if leakage still occurs despite correct tightening torque.

– Then perform test drive (more than 20 km), accelerating at least once to full load before checking high-pressure section again for leaks.

Note

If there is still air in the fuel system, the engine may switch to emergency running mode during the test drive. Switch off the engine and erase the fault memory. Then continue with the test drive.

1.20 Removing and installing high-pressure pump

Removing

Caution

Always read rules for cleanliness and instructions for working on fuel system ⇒ page 47 .

Follow these instructions before starting work and while working on the fuel system.

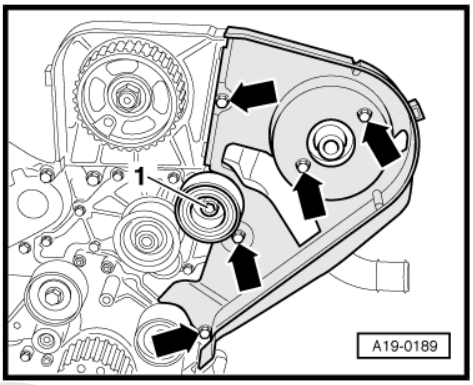
Note

All cable ties unfastened or severed on removal must be re-attached in the same position on installation.

– Remove toothed belt ⇒ 8-cyl. TDI engine, mechanics; Rep. Gr. 13; Dismantling and assembling engine; Removing and installing toothed belt

– Unscrew idler wheel -1-.

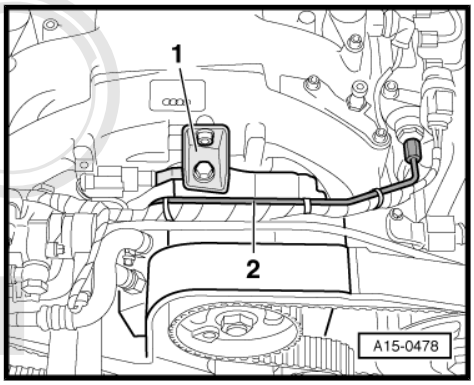
– Screw out bolts -arrows- and detach toothed belt guard at rear left.



– Remove retaining bracket -1-.

– Unfasten cable tie and lay bare wire.

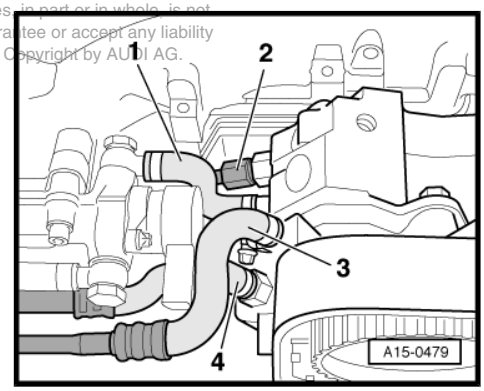
– Remove injector pipe -2-.



Note

Immediately seal injector pipe and connections at rail elements with protective caps.

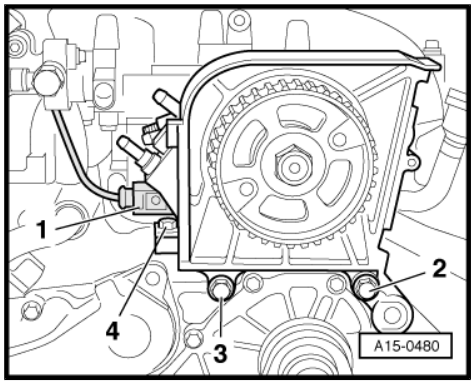
– Disconnect fuel pipes -1 ... 4- from high-pressure pump.



Note

Immediately seal all high-pressure pump connections with protective caps.

– Unplug connector -1-.
– Screw out bolts -2 ... 4-.
– Detach high-pressure pump.
– Following removal, immediately fit protective caps at high-pressure pump connections.



Installing

Install in reverse order; paying attention to the following:

– Visually inspect high-pressure pump and connection area for damage.
– Make sure all high-pressure pump connections are fitted with sealing plugs until all pipes have been installed.
– Heed tightening torques.
– Fit toothed belt (adjust timing) ⇒ 8-cyl. TDI engine, mechanics; Rep. Gr. 13; Dismantling and assembling engine; Removing and installing toothed belt
– Bleed fuel system before starting engine ⇒ page 96 .

Tightening torques

Component		Nm
High-pressure pump to cylinder block		22
Retaining bracket to	High-pressure pump	22
	Intake manifold	22
Injector pipes		22
Toothed belt guard, rear to engine		10
Idler wheel to engine		70
Drive gear to high-pressure pump		70

– After bleeding fuel system, leave engine running at moderate speed for a few minutes and then switch off again.
– Check fuel system for leaks.
– Then perform a test drive, accelerating at least once to full load before checking the high-pressure section again for leaks.

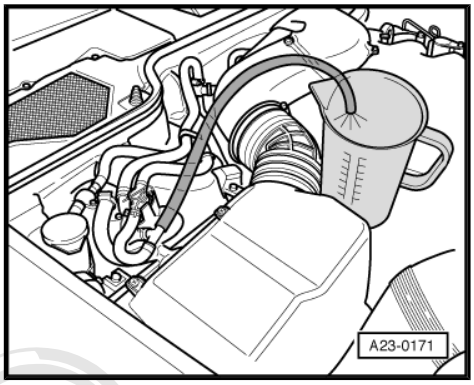
1.21 Bleeding fuel system after installing high-pressure pump

Following installation, the high-pressure pump must be filled with fuel before starting the engine.

Note

- *When installing the high-pressure pump, it is essential to ensure that no dirt enters the fuel system.*
- *Only remove sealing plugs immediately prior to installation of fuel pipes.*
- *There must be sufficient fuel in the tank.*

– Disconnect return pipe at fuel filter. Attach transparent hose to the T-piece and route this hose into a beaker.



– Connect fault reader and select engine electronics control unit 1 with “address word” 01. When doing this, the ignition must be switched on.
– Select “Final control diagnosis” function.
– Perform final control diagnosis as far as control element fuel pump relay -J17- (for filling baffle housing in tank).

Checking fuel pump relay -J17-

The fuel pump must start up every 5 seconds and then stop again (listen in area of rear right wheel housing).

– Leave this control element activated for approx. 30 seconds (to fill baffle housing in tank).

If the fuel pump is not actuated:

– Check fuel pump actuation. ⇒ Fuel supply system - diesel engines; Rep. Gr. 20; Fuel supply system

Electric fuel pump 2 relay -J49-

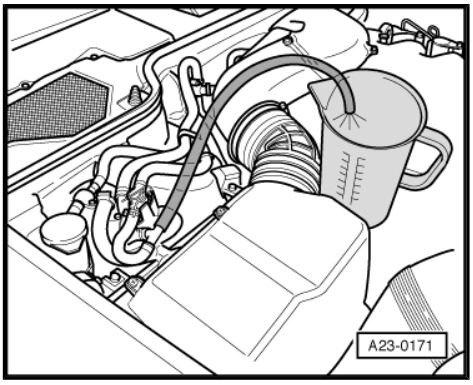
Electric fuel pump 2 must start up every 5 seconds and then stop again (listen in area of rear right wheel housing).

If electric fuel pump 2 is not actuated:

– Check actuation of electric fuel pump 2 ⇒ Fuel supply system - diesel engines; Rep. Gr. 20; Electrical checking of fuel pump

– Leave this control element activated for approx. 30 seconds.

Fuel must emerge from open return pipe.



– If fuel does not yet emerge, repeat actuation of both control elements.

If fuel emerges at return pipe, terminate final control diagnosis.

– Re-connect return pipe to T-piece.
– Connect all sensors and actuators before starting engine.
– Start engine (starting operation: max. 60 seconds).
– Run engine at moderate speed for several minutes and then switch off.
– Check fuel system for leaks.
– Then perform a test drive, accelerating at least once to full load before checking the high-pressure section again for leaks.
– Interrogate fault memory.

1.22 Checking pre-supply pressure of fuel system

– Insert a suitable pressure gauge in fuel supply pipe between gear pump and high-pressure pump.
– Measure fuel pressure on starting.

  Specification: approx. 2.5 bar

– Allow engine to idle.

  Specification: approx. 5.0 bar

If reading does not match specification, allow high-pressure pump to draw in diesel fuel directly from a fuel canister by way of gear pump.

Note

This is designed to establish whether there is an absence of fuel pressure upstream or downstream of the fuel filter.

– Disconnect fuel supply pipe directly at fuel filter outlet.
– Extend the fuel supply pipe with a hose.
– Insert hose into a full fuel canister.

Note

- *On installation in fuel system, make sure no dirt enters the fuel system.*
- *There must also not be any dirt or particles in the fuel canister, as the fuel is not filtered but rather supplied directly to the fuel system.*

– Measure fuel pressure at pressure gauge on starting.

  Specification: approx. 2.5 bar

– Allow engine to idle.

  Specification: approx. 5.0 bar

If reading now matches specification, check whether fuel filter is clogged.

If fuel filter is OK, check fuel pipes between fuel filter and fuel tank.

If reading again does not match specification, check return flow rate of injectors ⇒ page 82 .

If injectors are OK, replace gear pump.

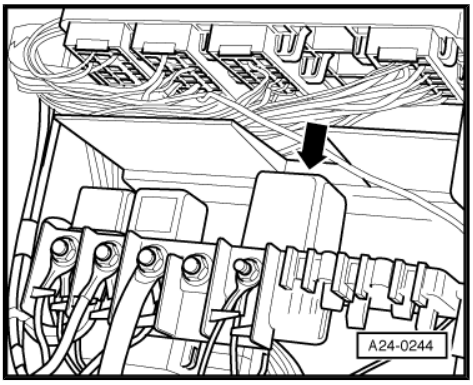
1.23 Checking terminal 30 voltage supply relay -J317- (diesel direct injection system control unit -J248-)

The terminal 30 voltage supply relay -J317- is responsible for the injection system power supply.

The relay only closes when voltage is applied via terminal 15 to the diesel direct injection system control unit, i.e. the relay is only connected to earth (via engine control unit 1) when engine control unit 1 is supplied with voltage via terminal 15.

Note

The terminal 30 voltage supply relay -J317- is located in the micro-central electrics in the electronics box in the passenger's footwell (relay position 4).



Checking engine control unit 1 power supply via terminal 15

– Connect test box -V.A.G 1598/30- to wiring harness to diesel direct injection system control unit -J248- ⇒ page 68 .
– Connect portable multimeter (voltage measuring range) to socket 4/26 of test box and earth.
– Switch on ignition.

Specification: approx. battery voltage

If reading does not match specification:

– Check wiring. ⇒ Current flow diagrams, Electrical fault finding and Fitting locations
– Connect portable multimeter (voltage measuring range) to socket 1/07 of test box and earth.
– Switch on ignition.

Specification: approx. battery voltage

If reading does not match specification:

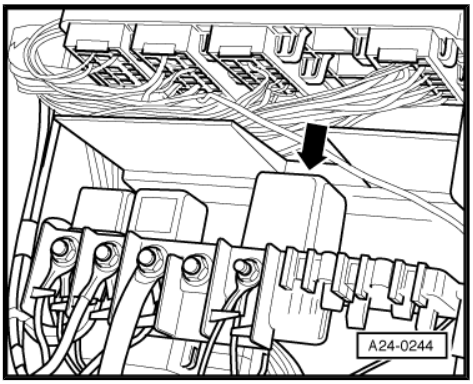
– Check wiring. ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

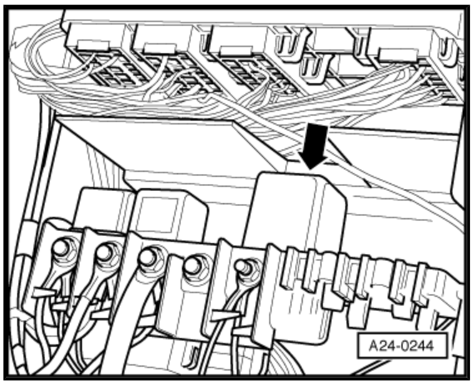
Checking switched earth connection of terminal 30 voltage supply relay -J317-

- Both engine control units connected
- Battery voltage OK
- Terminal 15 voltage supply OK
- Relay inserted in relay socket

– Switch on ignition.

  Specification: Terminal 30 voltage supply relay -J317- must be energised





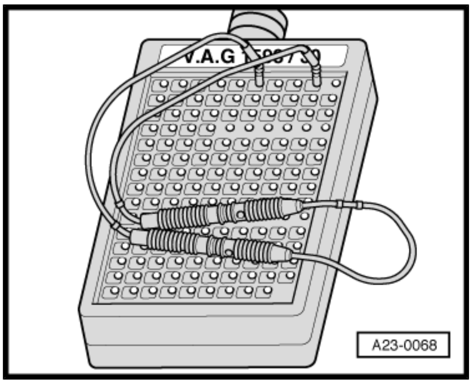
Note

- *The terminal 30 voltage supply relay -J317- is located in the micro-central electrics in the electronics box in the passenger's footwell (relay position 4).*
- *Clicking of the relay is not readily audible and can thus best be determined by way of touch.*

If reading does not match specification:

– Switch off ignition.

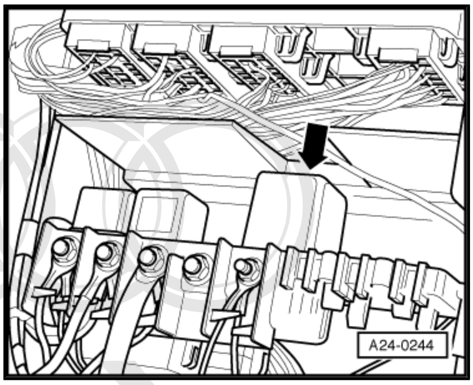
– Connect test box -V.A.G 1598/30- to wiring harness to diesel direct injection system control unit -J248- .



– Inter-connect sockets 1/06 and 1/09 of test box with a test lead from -V.A.G 1594/1;Messleitungen- .

– Switch on ignition.

Specification: Terminal 30 voltage supply relay -J317- must be energised



Note

- *The terminal 30 voltage supply relay -J317- is located in the micro-central electrics in the electronics box in the passenger's footwell (relay position 4).*
- *Clicking of the relay is not readily audible and can thus best be determined by way of touch.*

If relay is now energised, but not with control unit connected:

– Replace diesel direct injection system control unit -J248- ⇒ page 69 .

If relay is not energised:

– Switch off ignition.

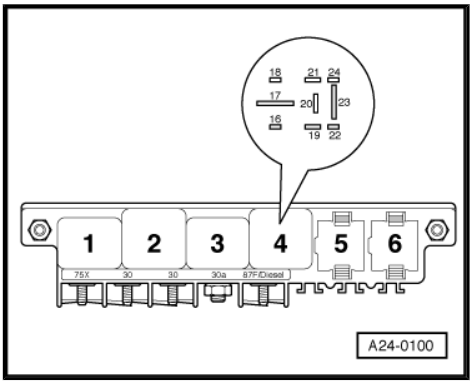
– Remove terminal 30 voltage supply relay from relay socket (micro-central electrics in electronics box in passenger's footwell, relay position 4).

– Check for open circuit and short to earth or positive in the following wiring:

Micro-central electrics on right in passenger's footwell, position 4 Contact	Test box -V.A.G 1598/30- Socket
16	1/09

Resistance: max. 1.5 ohms

– Eliminate open circuit in wiring or short circuit if necessary. ⇒ Current flow diagrams, Electrical fault finding and Fitting locations



Checking terminal 30 power supply

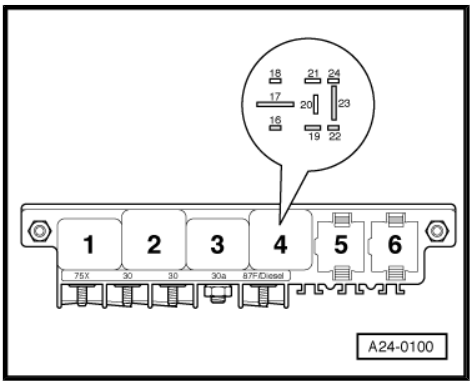
- Battery voltage OK
- Terminal 15 voltage supply OK
- Switched earth connection of terminal 30 voltage supply relay -J317- OK

– Switch off ignition.

– Remove terminal 30 voltage supply relay -J317- from relay socket.

Note

The terminal 30 voltage supply relay -J317- is located in the micro-central electrics in the electronics box in the passenger's footwell (relay position 4).



– Connect portable multimeter (voltage measuring range) to the following relay socket contacts:

Micro-central electrics on right in passenger's footwell, position 4 Contact	Test box -V.A.G 1598/30- Socket
17 + earth	approx. battery voltage
19 + earth	approx. battery voltage

If reading does not match specification:

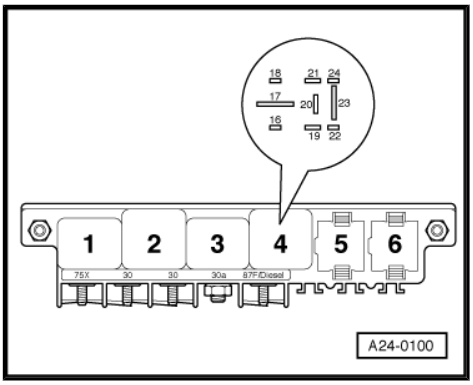
– Check wiring. ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

If reading matches specification, check power supply.

Checking engine control unit 1 power supply via terminal 30

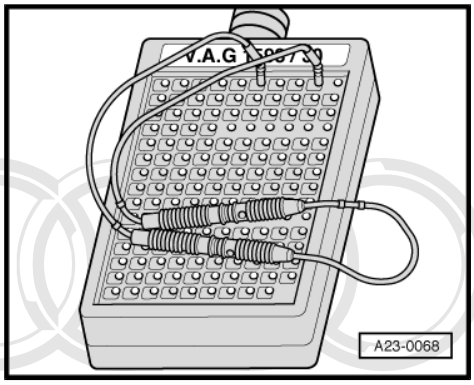
– Re-connect terminal 30 voltage supply relay to relay socket (relay position 4).

– Connect test box -V.A.G 1598/30- to wiring harness to diesel direct injection system control unit -J248- ⇒ page 68 .



– Inter-connect sockets 1/06 and 1/09 of test box with a test lead from -V.A.G 1594/1;Messleitungen- .

– Connect portable multimeter (voltage measuring range) to the following contacts of test box -V.A.G 1598/30- .



Test box -V.A.G 1598/30- , socket	Specification
1/01 + 1/04	approx. battery voltage
1/01 + 1/05	approx. battery voltage
1/08 + 1/04	approx. battery voltage
1/08 + 1/05	approx. battery voltage

If readings do not match specifications:

– Check wiring. ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

1.24 Checking terminal 30 voltage supply relay (diesel direct injection system control unit 2 -J494-)

Checking engine control unit 2 power supply via terminal 15

– Connect test box -V.A.G 1598/30- to wiring harness to engine control unit 2 -J494- ⇒ page 68 .

– Connect portable multimeter (voltage measuring range) to socket 4/26 of test box and earth.

– Switch on ignition.

Specification: approx. battery voltage

If reading does not match specification:

– Check wiring. ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

– Connect portable multimeter (voltage measuring range) to socket 1/07 of test box and earth.

– Switch on ignition.

Specification: approx. battery voltage

If reading does not match specification:

– Check wiring. ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

Checking engine control unit 2 power supply via terminal 30

– Switch on ignition.

– Connect portable multimeter (voltage measuring range) to the following contacts of test box -V.A.G 1598/30- .

Test box -V.A.G 1598/30- Socket	Specification
1/01 + 1/04	approx. battery voltage
1/01 + 1/05	approx. battery voltage
1/01 + 1/06	approx. battery voltage
1/01 + 3/06	approx. battery voltage

Test box -V.A.G 1598/30- Socket	Specification
1/08 + 1/04	approx. battery voltage

Test box -V.A.G 1598/30- Socket	Specification
1/08 + 1/05	approx. battery voltage
1/08 + 1/06	approx. battery voltage
1/08 + 3/06	approx. battery voltage
3/31 + 1/04	approx. battery voltage
3/31 + 1/05	approx. battery voltage
3/31 + 1/06	approx. battery voltage
3/31 + 3/06	approx. battery voltage

If readings do not match specifications:

– Check wiring ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

If readings match specifications:

– Replace terminal 30 voltage supply relay -J317- (micro-central electrics in electronics box in passenger's footwell, relay position 4).

1.25 Checking engine speed sender -G28-

Note

- *The engine speed sender is a combined engine speed and reference mark sender.*
- *The engine will not run in the event of engine speed sender failure.*

Fitting location of connector ⇒ page 48

– Check proper installation and attachment of sender before performing test.

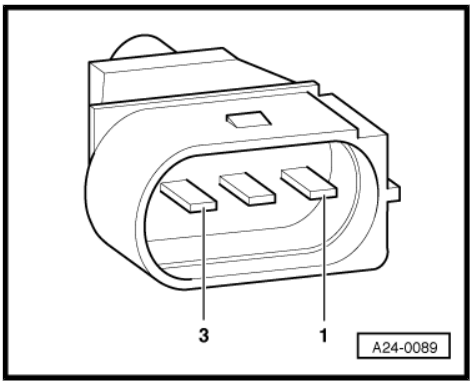
– There must not be any swarf or damage at engine speed sender/sender wheel.

– Thickness of spacer between sender and gearbox must be 4.5 mm.

– Unplug connector of engine speed sender (identification: grey connector).

– Connect -V.A.G 1526B;Handmultimeter- (resistance measuring range) with test lead from -V.A.G 1594/1;Messleitungen- to contacts 2 and 3 of engine speed sender connector.

Specification: Approx. 450...1000 Ω



Note

- *The resistance value for the engine speed sender is based on a temperature of 20 °C.*
- *As the temperature increases, so does the resistance.*

If reading does not match specification:

– Replace engine speed sender.

If reading matches specification:

– Connect -V.A.G 1526B;Handmultimeter- (resistance measuring range) between contacts 2 and 1 (earth) as well as to contacts 3 and 1 (earth).

  Specification: Infinity Ω in each case (no continuity)

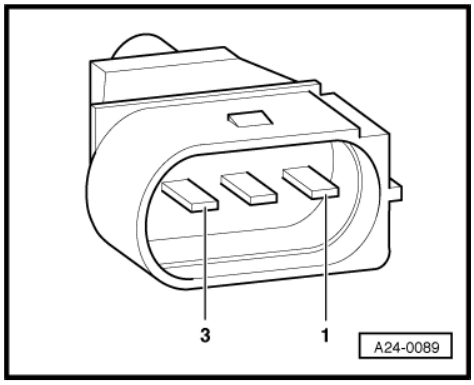
If reading does not match specification:

– Replace engine speed sender.

If reading matches specification:

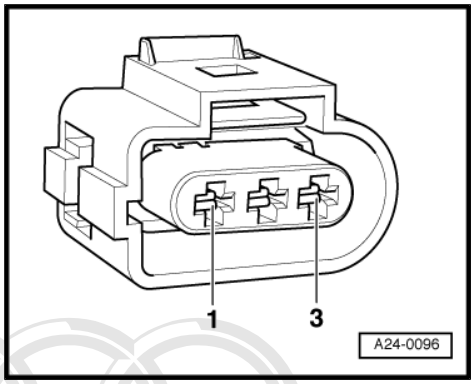
– Check wiring between sender connector and diesel direct injection system control unit -J248- as follows:

– Connect test box -V.A.G 1598/30- to wiring harness to diesel direct injection system control unit -J248- ⇒ page 68 .



– Check for open circuit and short to earth or positive in the following wiring:

3-pin connector at wiring harness Contact	Test box -V.A.G 1598/31- Socket
1 (screen)	108
2 (earth wire)	90
3 (signal wire)	82



Resistance: max. 1.5 ohms ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

– Eliminate open circuit in wiring or short circuit if necessary.

If no fault is found in wiring:

– Slowly crank engine and check concentricity/firm attachment of sender wheel.

– If none of the preceding checks has revealed any faults, replace diesel direct injection system control unit -J248- ⇒ page 69 .

1.26 Checking coolant temperature sender - G62-

– Connect fault reader and select “01 Engine control unit for engine electronics 1 -248”. The engine must be idling when doing so.

– Read measured value block “Function 08” display group 07, cold engine.

– Check display in zone 4 (coolant temperature).

  Specification: The temperature value must increase at a uniform rate.

In the event of a fault, the fuel temperature in “display zone 1” is shown as substitute value.

If display in zone 4 is not realistic or if fuel temperature is displayed as substitute value:

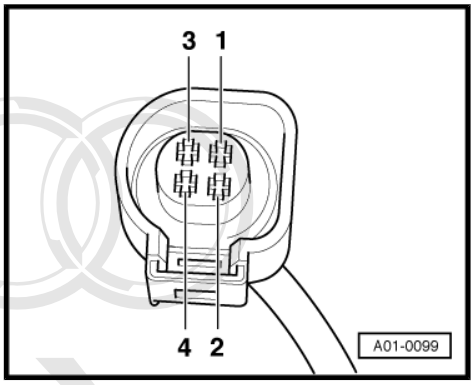
– Switch off ignition.

– Unplug connector at sender ⇒ Exploded view of fitting locations, page ⇒ page 48 .

– Connect test box -V.A.G 1598/30- to wiring harness to diesel direct injection system control unit -J248- ⇒ page 68 .

– Check for open circuit and short to earth or positive in the following wiring:

4-pin connector at wiring harness Contact	Test box -V.A.G 1598/30- Socket
3	3/32 (earth)
4	3/28



Resistance: max. 1.5 ohms

– Eliminate open circuit in wiring or short circuit if necessary. ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

If no fault is found in wiring:

– Replace coolant temperature sender -G62- .

1.27 Checking intake air temperature sender -G42-

For fitting location of sender (joint component: Air mass meter and intake air temperature sender, right air mass meter -G70- in direction of travel), refer to ⇒ page 48 .

– Connect fault reader and use “address word” 01 to select engine control unit for engine electronics 1 -J248- . When doing this, the ignition must be switched on.

– Read measured value block “Function 08” display group 07, cold engine, ignition on.

– Observe display in zone 3.

A substitute value of 60 °C is displayed in the event of an open circuit in the wiring to the sender.

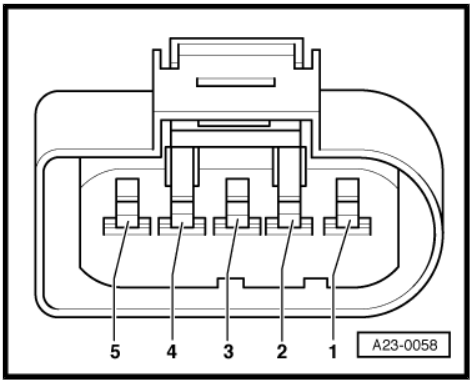
If the display is not realistic or if a temperature of 60 °C is displayed as substitute value:

– Connect test box -V.A.G 1598/30- to wiring harness to diesel direct injection system control unit -J248- ⇒ page 68 .

– Unplug connector from air mass meter -G70- .

– Check for open circuit and short to earth or positive in the following wiring:

5-pin connector at wiring harness Contact	Test box -V.A.G 1598/30- Socket
1	3/29
3	3/03



Resistance: max. 1.5 ohms

– Eliminate open circuit in wiring or short circuit if necessary. ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

If no fault is found in wiring:

– Replace air mass meter -G70- (joint component: Air mass meter and intake air temperature sender).

1.28 Checking oil temperature sender -G8-

– Connect fault reader and use “address word” 01 to select engine control unit for engine electronics 1 -J248- . The engine must be idling when doing so.

– Read measured value block “Function 08” display group 07, engine cold and idling.

– Observe display in zone 2.

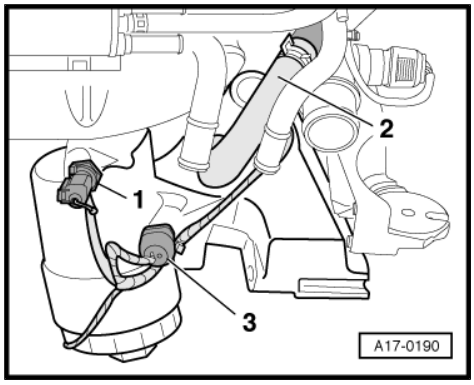
Specification: The temperature value must increase at a uniform rate.

If display in zone 2 is not realistic:

– Switch off ignition.

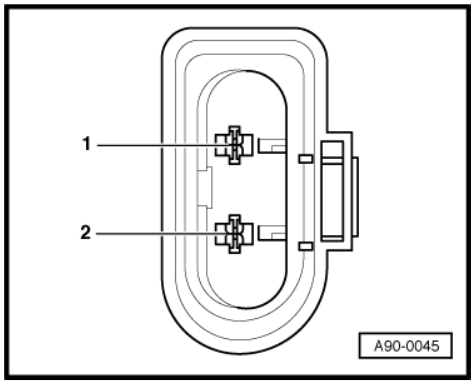
– Unplug connector at oil temperature sender -G8- .

The oil temperature sender -G8- is fitted in the oil filter bracket -3-.



– Connect test box -V.A.G 1598/30- to wiring harness to diesel direct injection system control unit -J248- ⇒ page 68 .

– Check for open circuit and short to earth or positive in the following wiring:



2-pin connector at wiring harness Contact	Test box -V.A.G 1598/30- Socket
1	3/34 (earth)
2	3/27

Resistance: max. 1.5 ohms

– Eliminate open circuit in wiring or short circuit if necessary. ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

If no fault is found in wiring:

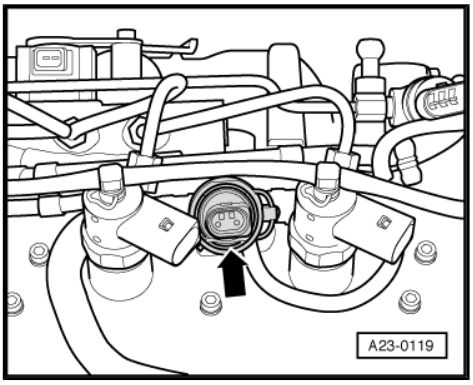
– Replace oil temperature sender -G8- .

1.29 Checking fuel temperature sender -G81-

The fuel temperature is recorded in the return pipe of the injectors.

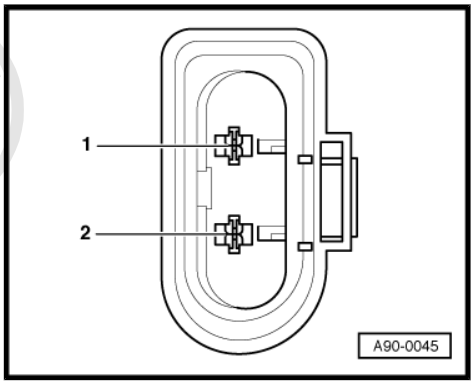
– Unplug connector at fuel temperature sender.

– Connect test box -V.A.G 1598/30- to wiring harness to diesel direct injection system control unit -J248- ⇒ page 68 .



– Check for open circuit and short to earth or positive in the following wiring:

2-pin connector at wiring harness Contact	Test box -V.A.G 1598/30- Socket
1	3/18 (earth)
2	3/11



Resistance: max. 1.5 ohms

– Eliminate open circuit in wiring or short circuit if necessary. ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

If no fault is found in wiring:

– Replace fuel temperature sender -G81- .

1.30 Checking fuel pressure sender -G247-

The fuel pressure sender -G247- measures the current pressure in the high-pressure system and supplies the diesel direct injection system control unit -J248- with a voltage signal.

Overview of fitting locations ⇒ page 48

Note

- *Prior to measurement, fuel pressure sender -G247- must be calibrated with ignition on.*
- *The engine must have been stopped for more than 30 seconds.*

– Connect fault reader and use “address word” 01 to select engine control unit for engine electronics 1 -J248- . When doing this, the ignition must be switched on.

– Read measured value block “Function 08” display group 22.

• Rail pressure actual value in display zone 3: Less than 10 bar

If actual value is not attained, replace fuel pressure sender -G247- .

If actual value is attained:

– Start engine.

– Read measured value block “Function 08” display group 22.

The following rail pressure must be generated for a warm engine:

• Rail pressure specification in display zone 2: 275 ± 25 bar

- Rail pressure actual value in display zone 3: As display zone 2 ± 10 bar

Note

A higher rail pressure is displayed with a cold engine.

If actual value is not attained:

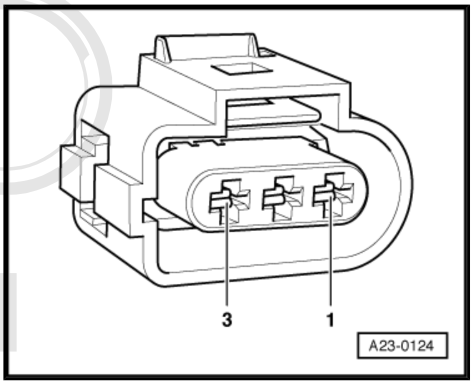
– Switch off ignition.

– Check wiring.

– Unplug connector at fuel pressure sender -G247- .

– Connect test box -V.A.G 1598/30- to wiring harness to diesel direct injection system control unit -J248- ⇒ page 68 .

– Check for open circuit and short to earth or positive in the following wiring:



3-pin connector at wiring harness Contact	Test box -V.A.G 1598/30- Socket
1	3/20
2	3/33
3	3/35

Resistance: max. 1.5 ohms

– Eliminate open circuit in wiring or short circuit if necessary. ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

If no fault is found in wiring:

– Replace fuel pressure sender -G247- .

1.31 Checking fuel pressure regulating valve -N276-

The fuel pressure regulating valve is located in the distributor housing. It maintains a constant pressure in the rail and the injector pipes (high-pressure circuit).

If the pressure in the rail is too high, the regulating valve opens to allow some of the fuel to flow back from the rail to the fuel tank via a return pipe.

If the pressure in the rail is too low, the regulating valve closes and seals off the high-pressure section from the low-pressure section.

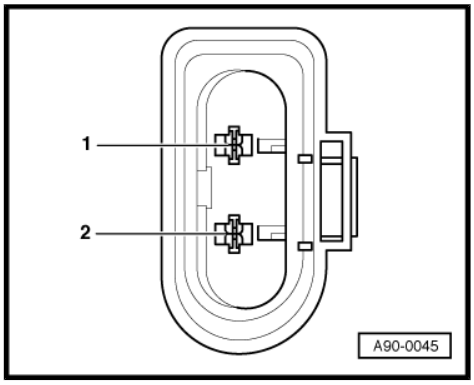
Overview of fitting locations ⇒ page 48

Checking power supply

– Unplug connector at fuel pressure regulating valve -N276- .

– Connect portable multimeter (voltage measuring range) to the following connector socket:

2-pin connector at wiring harness Contact	Specification
2 + earth	Battery voltage



– Operate starter.

Specification: approx. battery voltage

If reading does not match specification:

– Check for continuity in wiring from contact 1 via fuse to terminal 30 voltage supply relay -J317- and repair if necessary. ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

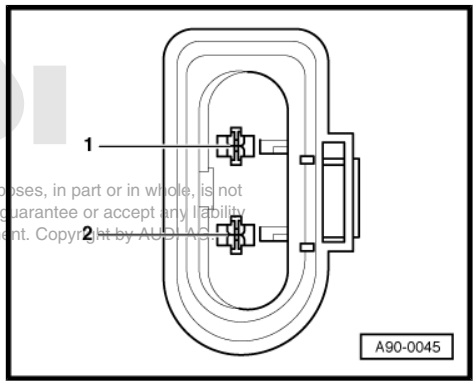
If reading matches specification, check actuation of regulating valve.

Checking actuation

– Connect test box -V.A.G 1598/30- to wiring harness to diesel direct injection system control unit -J248- ⇒ page 68 .

Check the following wiring for short to positive or earth and open circuit.

2-pin connector at wiring harness Contact	Test box -V.A.G 1598/30- Socket
1	3/38



– Eliminate open circuit in wiring/short circuit if necessary. ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

If no fault is found in wiring:

– Replace fuel pressure regulating valve -N276- .

1.32 Checking fuel metering valve -N290-

The fuel metering valve -N290- is installed in the high-pressure pump. Renewing the solenoid valve involves replacing the entire high-pressure pump.

The high-pressure pump supplies far more fuel than is delivered by the injectors. The high-pressure pump is therefore driven at camshaft speed by the engine management system toothed belt.

In addition, the fuel metering solenoid valve is responsible for fuel return as a function of power. Thus the amount of fuel delivered and compressed is only slightly in excess of that injected so as to reduce the pump power requirement and the extent to which the fuel heats up.

Note

The fuel metering valve -N290- is actuated by diesel direct injection system control unit 2 -J494- .

Checking power supply

– Connect portable multimeter (voltage measuring range) to contact 2 of connector and earth.

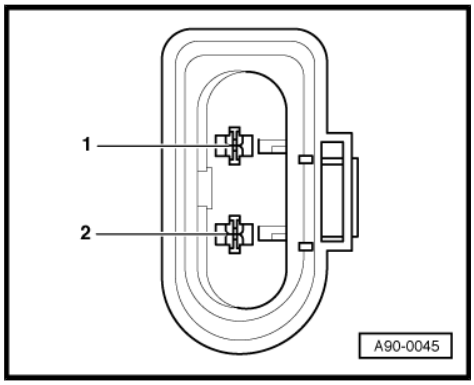
– Switch on ignition.

Specification: approx. battery voltage

If reading does not match specification:

– Check for continuity in wiring from contact 2 via fuse to terminal 30 voltage supply relay -J317- and repair if necessary. ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

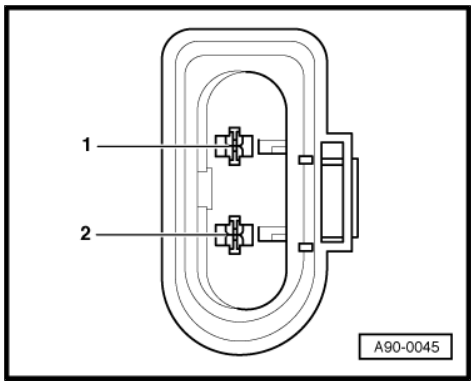
If reading matches specification, check wiring to diesel direct injection system control unit 2 -J494- .



Checking wiring to diesel direct injection system control unit 2 -J494-

– Connect test box -V.A.G 1598/30- to wiring harness to diesel direct injection system control unit 2 -J494- ⇒ page 68 .

Check the following wiring for short to positive or earth and open circuit.



2-pin connector at wiring harness Contact	Test box -V.A.G 1598/30- Socket
1	3/38

– Eliminate open circuit in wiring/short circuit if necessary. ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

If no fault is found in wiring:

– Replace fuel metering valve -N290- (replace high-pressure pump, joint renewal only).

1.33 Checking air mass meter -G70- and air mass meter 2 -G246-

The air mass meter signal is required by the engine control unit for calculating the permissible injection quantity and for controlling exhaust gas recirculation. The lower the signal from the air mass meter, the less fuel may be injected.

– Connect fault reader and use “address word” 01 to select engine control unit for engine electronics 1 -J248- . The engine must be idling when doing so.

– Read measured value block “Function 08” display group 10.

– Increase engine speed to 3100 - 3200 rpm (display zone 4 approx. 18%).

A mean value for the two air mass meters is shown in display zone 1.

Specification: 475...650 mg/S

Note

- *In the event of failure of one of the air mass meters, the value for the second air mass meter is used as a substitute.*
- *A fixed value of 480 mg/stroke is displayed in the event of failure of both air mass meters.*

If the reading does not match the specification at an engine speed of 3100 to 3200 rpm, check the exhaust gas recirculation system:

– Start basic setting “Function 04” display group 003 ⇒ page 22 .

The exhaust gas recirculation actual value is displayed in zone 3.

Zone 2 shows whether or not exhaust gas recirculation is active.

Specification in display zone 2: Exhaust gas recirculation active

Specification in display zone 3: 100...200 mg/stroke

Specification in display zone 2: Exhaust gas recirculation not active

Specification in display zone 3: 380...500 mg/stroke

If readings do not match specifications in zone 3, check exhaust gas recirculation system. ⇒ 8-cyl. TDI engine, mechanics; Rep. Gr. 26; Exhaust gas recirculation system

If readings still do not match specifications, use basic setting “Function 04” display group 33 to determine the defective air mass meter.

The turbochargers are actuated alternately with the duty cycles “low delivery” and “full delivery”. In one period, the right turbocharger is actuated at “low delivery” and the left turbocharger is simultaneously actuated at “full delivery”. In the next period, the turbochargers are actuated with interchanged duty cycles.

Display zone 2 shows which turbocharger is being actuated.

Specification in display zone 2: Turbocharger 1 on (actuation: left turbocharger “low delivery” and right turbocharger “full delivery”)

The air mass of the air mass meter -G70- is displayed in zone 3.

Specification in display zone 3: 550...800 mg/stroke

The air mass of air mass meter 2 -G246- is displayed in zone 4.

Specification in display zone 4: 100...300 mg/stroke

Specification in display zone 2: Turbocharger 2 on (actuation: left turbocharger “full delivery” and right turbocharger “low delivery”)

Specification in display zone 3: 100...300 mg/stroke

Specification in display zone 4: 550...800 mg/stroke

If the readings do not match the specifications in display zone 3 or 4, check the charge air system. ⇒ 8-cyl. TDI engine, mechanics; Rep. Gr. 21; Checking charge air system with turbocharger

If the turbochargers are OK, check the air mass meters.

Air mass meter -G70- ⇒ page 111

Air mass meter 2 -G246- ⇒ page 113

1.34 Electrical checking of air mass meter -G70-

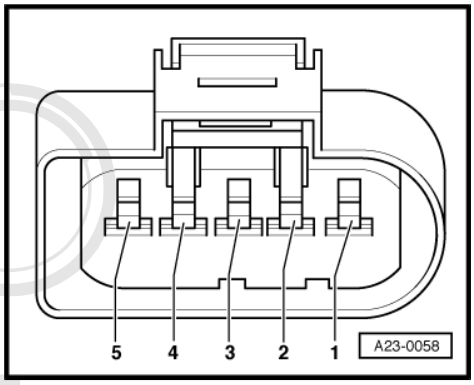
Overview of fitting locations ⇒ page 48

Checking power supply

– Unplug connector from air mass meter -G70- .

– Connect portable multimeter (voltage measuring range) to socket 2 of connector and engine earth.
– Briefly operate starter.

Specification: approx. battery voltage



Note

The air mass meter -G70- is supplied with power by the terminal 30 voltage supply relay -J317- .

If there is no battery voltage:

– Check for open circuit or short to earth in wiring from socket 2 of connector via fuse to terminal 30 voltage supply relay -J317- and repair if necessary. ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

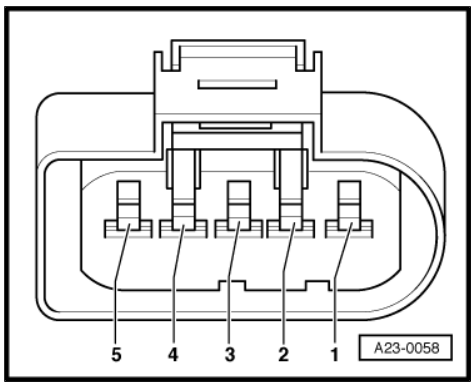
If reading matches specification:

– Check engine control unit earth supply.

Checking earth supply

– Connect portable multimeter (voltage measuring range) to sockets 2 and 3 of connector.
– Briefly operate starter.

Specification: approx. battery voltage

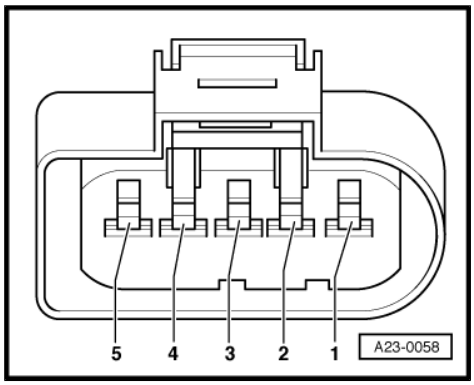


Note

Engine control unit earth is applied to socket 3 of connector.

If reading does not match specification:

– Connect portable multimeter (voltage measuring range) to sockets 3 and 4 of connector.
– Switch on ignition.



Specification: approx. 5 V

If one reading does not match specification:

– Check wiring.

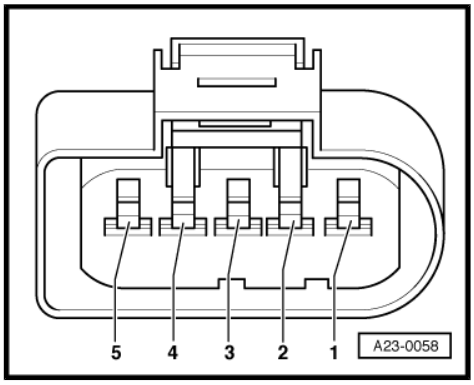
Checking wiring

Note

The wiring test also checks the signal wire.

– Connect test box -V.A.G 1598/30- to wiring harness to diesel direct injection system control unit -J248- ⇒ page 68 .

– Check for open circuit and short to positive or earth in the following wiring:



Connector for air mass meter - G70- Socket	Test box -V.A.G 1598/30- Socket
3	3/03
4	3/01
5	3/02

Resistance: max. 1.5 ohms

– Eliminate open circuit in wiring or short circuit if necessary. ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

– Also check all wires for mutual short circuit.

Connector for air mass meter - G70- Socket	Test box -V.A.G 1598/30- Socket
3	3/01 and 3/02
4	3/03 and 3/02
5	3/03 and 3/01

Specification: infinity ohms (no continuity)

– If power supply and wiring are OK, replace air mass meter -G70- .

1.35 Electrical checking of air mass meter 2 -G246-

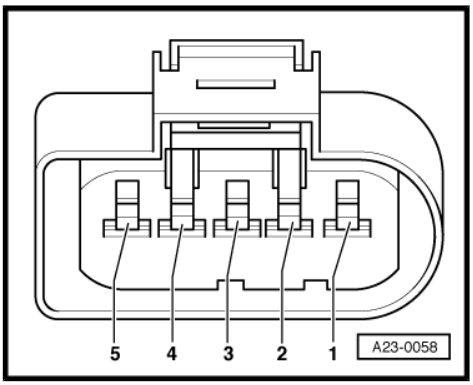
Overview of fitting locations ⇒ page 48

Checking power supply

– Unplug connector from air mass meter.

– Connect portable multimeter (voltage measuring range) to socket 2 of connector and engine earth.

– Briefly operate starter.



Specification: approx. battery voltage

Note

Air mass meter 2 -G246- is supplied with power by the terminal 30 voltage supply relay -J317- .

If there is no battery voltage:

– Check for open circuit or short to earth in wiring from socket 2 of connector via fuse to terminal 30 voltage supply relay -J317- and repair if necessary. ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

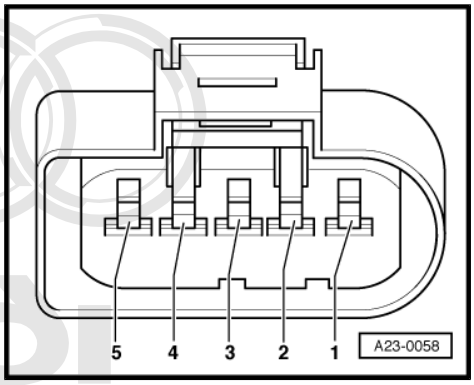
If reading matches specification:

– Check engine control unit earth supply.

Checking earth supply

– Connect portable multimeter (voltage measuring range) to sockets 2 and 3 of connector.
– Briefly operate starter.

Specification: approx. battery voltage



Note

Engine control unit earth is applied to socket 3 of connector.

If reading does not match specification:

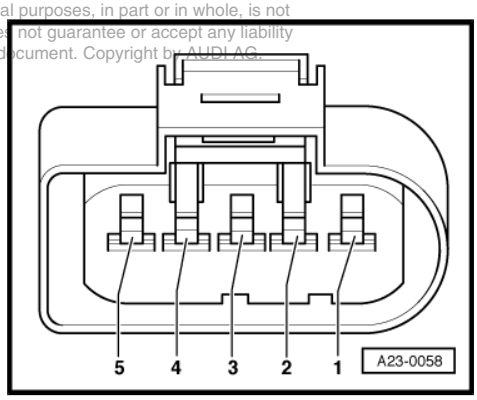
– Check wiring.

– Connect portable multimeter (voltage measuring range) to sockets 3 and 4 of connector.
– Switch on ignition.

Specification: approx. 5 V

If reading does not match specification:

– Check wiring.



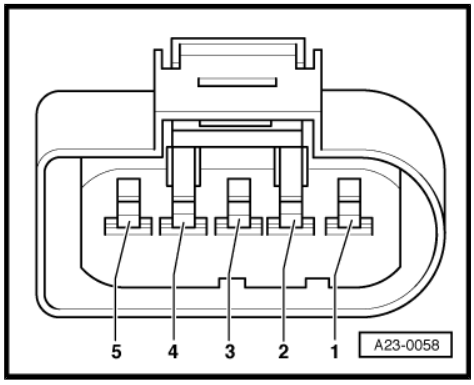
Checking wiring

Note

The wiring test also checks the signal wire.

– Connect test box -V.A.G 1598/30- to wiring harness to diesel direct injection system control unit -J248- ⇒ page 68 .

– Check for open circuit and short to positive or earth in the following wiring:

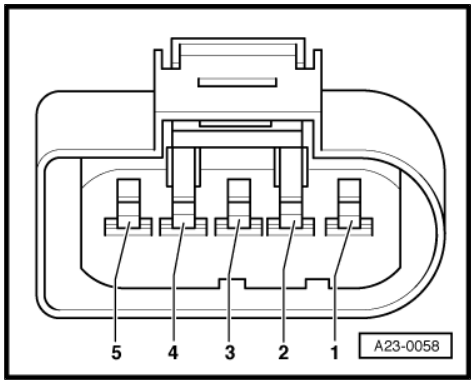


Connector for air mass meter 2 -G246- Socket	Test box -V.A.G 1598/30- Socket
3	3/22
4	3/36
5	3/21

Resistance: max. 1.5 ohms

– Eliminate open circuit in wiring/short circuit if necessary.
⇒ Current flow diagrams, Electrical fault finding and Fitting locations

– Also check all wires for mutual short circuit.



Connector for air mass meter 2 -G246- Socket	Test box -V.A.G 1598/30- Socket
3	3/36 and 3/21
4	3/22 and 3/21
5	3/26 and 3/22

Specification: infinity ohms (no continuity)

– If power supply and wiring are OK, replace air mass meter 2 -G246- .

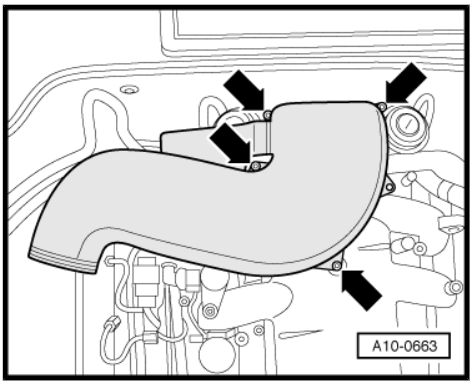
1.36 Removing and installing air mass meter

Note

All cable ties unfastened or severed on removal must be re-attached in the same position on installation.

Removing

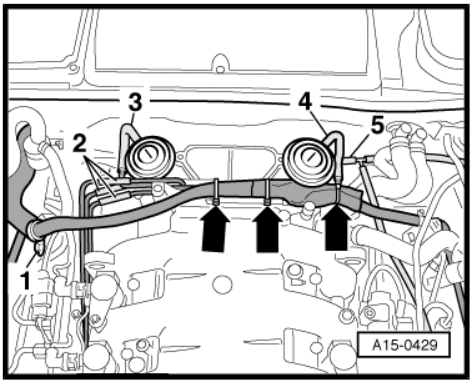
– Remove engine cover ⇒ page 66 .
– Disconnect hose to air cleaner housing at top air pipe.
– Remove top air pipe -arrows-.



Note

Seal off inlet connections with clean cloths.

– Unscrew clamp -1-.
– Sever cable ties -arrows-.
– Mark vacuum hoses -2- prior to disconnection.
– Disconnect vacuum hoses -2...5-.

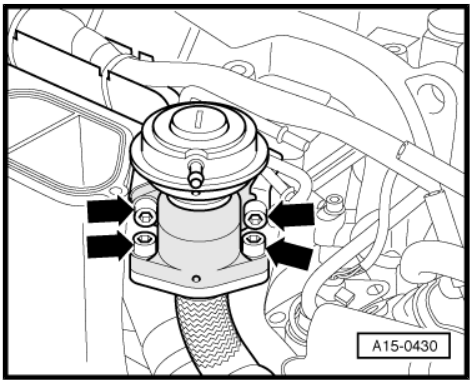


– Screw out bolts -arrows- at mechanical exhaust gas recirculation valves on both sides.

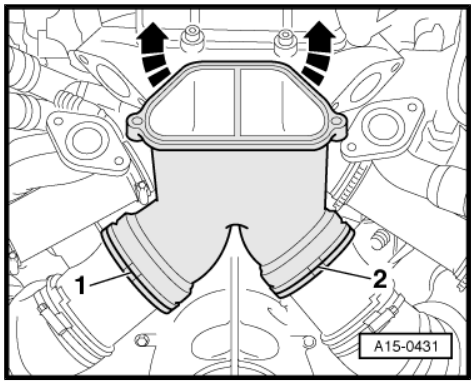
Note

Fig. shows right exhaust gas recirculation valve with engine removed.

– Detach mechanical exhaust gas recirculation valves.



– Pull out retaining clips -1- and -2- approx. 10 mm.



Note

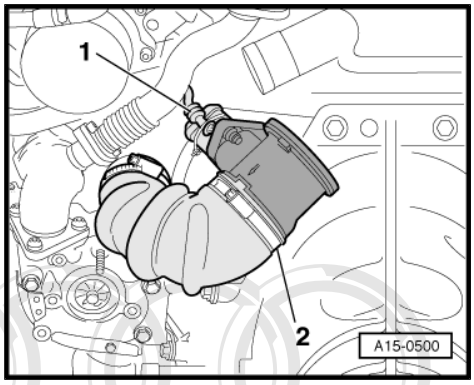
Illustration shows engine removed.

– Detach rear air pipe first from left and then from right air mass meter.
– Guide out rear air pipe upwards -arrows- with a twisting motion.

Note

- *Proceed as follows if rear air pipe cannot be removed:*
- *Turn clamps on connecting hoses slightly towards turbocharger so that ends of hose clamps no longer create an obstruction.*
- *Place a suitable wooden block on a trolley jack and position this behind ATF pan at gearbox housing.*
- *Use the trolley jack to raise the automatic gearbox slightly until the engine tilts forward somewhat, thus providing access to the bulkhead.*

– Unfasten hose clamp -2- and detach air mass meter from air hose.
– Unplug connector -1-.



Note

Illustration shows engine removed.

Installing

Install in reverse order; paying attention to the following:

Note

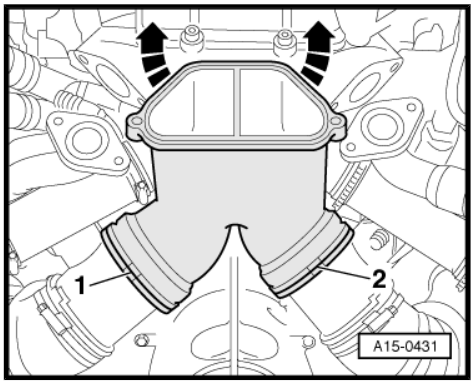
- *Replace gaskets and seals.*
- *Hose connections and hoses must be free of oil and grease before fitting.*

– Coat O-rings in rear air pipe with fuel.

Note

Do not use silicone spray or silicone-based lubricants, as the silicone could damage the air mass meters.

– Consecutively press the two air mass meters into the rear air pipe (the retaining clips -1- and -2- must be heard to engage).



Tightening torques

Component		Nm
Mechanical exhaust gas recirculation valve to intake manifold or connecting pipe		22
Top air pipe to	Rear air pipe	10
	Cylinder head	10

1.37 Checking variable intake manifold flap changeover valve -N239-

Overview of fitting locations ⇒ page 48

– Start engine.

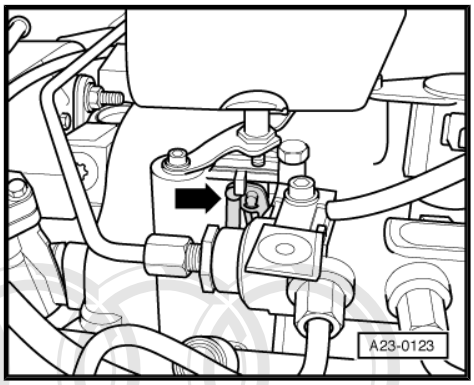
– Observe linkage of intake manifold flap whilst a second mechanic switches off the engine.

– On switching off the engine, the intake manifold flap must close for 1 to 2 seconds.

Measure resistance if intake manifold flap does not close as described.

Electrical checking of variable intake manifold flap changeover valve -N239-

– Unplug connector at changeover valve.



– Connect portable multimeter (resistance measuring range) to changeover valve.

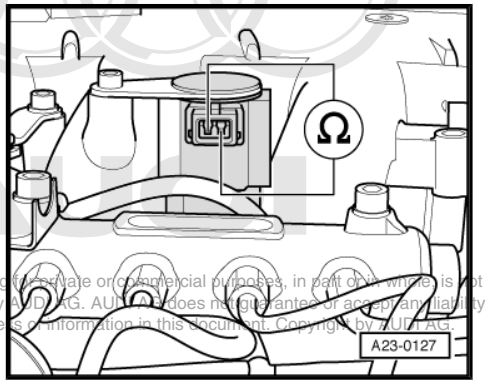
Specification: 14...20 Ω

If reading does not match specification:

– Replace variable intake manifold flap changeover valve -N239- .

If reading matches specification, perform voltage measurement.

Checking power supply for variable intake manifold flap changeover valve -N239-



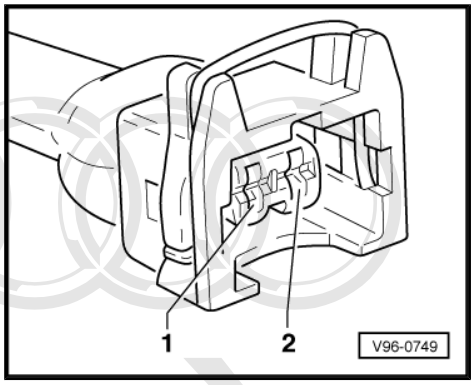
– Connect portable multimeter (voltage measuring range) to contact 2 of connector and earth.
– Switch on ignition.

Specification: approx. battery voltage

If reading does not match specification:

– Check for continuity in wiring from contact 2 via fuse to terminal 30 voltage supply relay -J317- and repair if necessary. ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

If reading matches specification, check wiring to diesel direct injection system control unit -J248- .

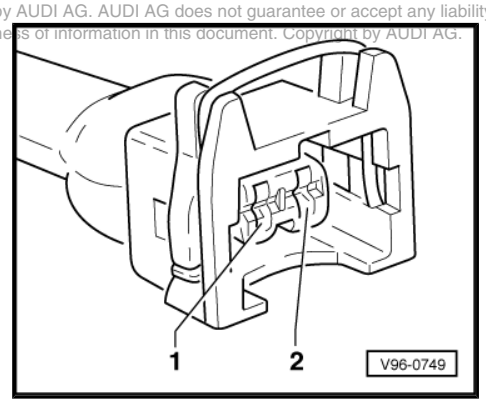


Checking wiring to diesel direct injection system control unit -J248-

– Connect test box -V.A.G 1598/30- to wiring harness to terminal 30 voltage supply relay -J317- ⇒ page 68 .

Check the following wiring for short to positive or earth and open circuit.

2-pin connector at wiring harness Contact	Test box -V.A.G 1598/30- Socket
1	2/20



– Eliminate open circuit in wiring/short circuit if necessary. ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

If no open circuit is found in wiring:

– Replace variable intake manifold flap changeover valve -N239- .

1.38 Checking Hall sender -G40-

The Hall sender supplies the ignition position for cylinder 1.

The engine will run even without a Hall sender signal.

It cannot however be started without a Hall sender signal.

Note

- *The Hall sender -G40- is located at the rear of the left cylinder head (bank 2).*
- *The connector contacts are numbered accordingly on the back of the connector.*

Checking power supply

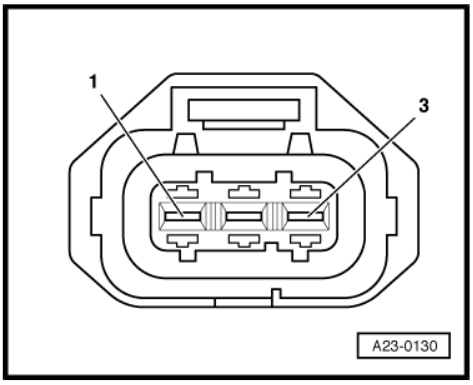
– Unplug connector at Hall sender.

– Connect portable multimeter -V.A.G 1526- (voltage measuring range) to socket 1 of connector and engine earth.
– Operate starter for a few seconds.

Specification: approx. battery voltage

Checking signal wire

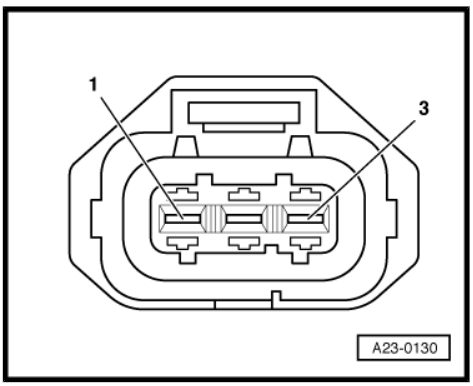
– Switch on ignition.



– Connect -V.A.G 1526B;Handmultimeter- (voltage measuring range) between socket 2 of connector and engine earth.

Specification: approx. battery voltage

Checking earth wire



– Connect -V.A.G 1526B;Handmultimeter- (resistance measuring range) between socket 1 of connector and engine earth.

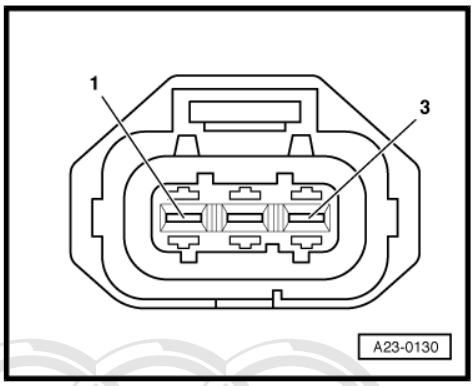
Specification: Continuity

Resistance: max. 1.5 ohms

If readings do not match specifications, check wiring connections.

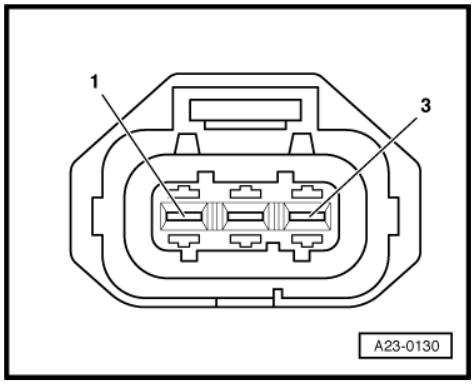
Checking wiring between Hall sender and engine control unit

– Connect test box -V.A.G 1598/30- to wiring harness to diesel direct injection system control unit -J248- ⇒ page 68 .



– Check wiring from Hall sender ....

– .... to engine control unit for open circuit and short to positive/ earth.



3-pin connector at wiring harness Socket	Test box -V.A.G 1598/30- Socket
1 (earth)	3/17
2 (signal)	3/04
3 (positive)	Check wiring to terminal 30 voltage supply relay -J317- . ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

Resistance: max. 1.5 ohms

– Eliminate open circuit in wiring or short circuit if necessary. ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

If readings do not match specifications, check wiring connections.

Checking actuation

– Insert diode test lamp in test box -V.A.G 1598/30- between contacts 1/08 and 3/04.

– Operate starter for a few seconds.

Specification: Diode test lamp must flash.

If diode test lamp does not flash, replace Hall sender.

If diode test lamp flashes and all the preceding checks were OK, but a fault relating to the Hall sender has been entered, replace diesel direct injection system control unit -J248- ⇒ page 69 .

1.39 Checking brake light switch -F- and brake pedal switch -F47-

As the injection system operates with an accelerator pedal sender (potentiometer) which could be defective, the engine speed is regulated for safety reasons when the brake is pressed. The control unit requires the brake light switch signal and also the brake pedal switch signal for this purpose.

This means that, if the brake is pressed with the accelerator pedal held steady, the engine speed is immediately regulated to idling speed. Incorrect switch settings may lead to undesired regulation.

– Connect fault reader and use “address word” 01 to select engine control unit for engine electronics 1 -J248- . When doing this, the ignition must be switched on.

– Read measured value block “Function 08” display group 06.

– Observe display in zone 2.

Specification: 0 0 0

– Slowly press brake.

Specification: 0 1 1 Both displays must switch from 0 to 1.

– Allow brake pedal to return slowly to rest position.

Specification: 0 0 0 Both displays must switch back from 1 to 0.

If one or both of the displays does not switch from 0 to 1:

– Check power supply.

Checking power supply

– Remove driver's storage compartment ⇒ Rep. Gr. 68 .

– Unplug 4-pin connector at brake pedal.

– Connect portable multimeter (voltage measuring range) to the following connector sockets:

– Switch off ignition.

4-pin connector at wiring harness Socket	Specification
1 + earth	Battery voltage

– Switch on ignition.

4-pin connector at wiring harness Socket	Specification
3 + earth	Battery voltage

If readings match specifications:

– Check wiring.

If readings do not match specifications:

– Check for open circuit/short to earth in wiring from sockets 1 and 3 of connector. ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

– Eliminate open circuit in wiring or short circuit if necessary.

Checking wiring to diesel direct injection system control unit -J248-

– Connect test box -V.A.G 1598/30- to wiring harness to diesel direct injection system control unit -J248- ⇒ page 68 .

Check the following wiring for short to positive or earth and open circuit.

4-pin connector at wiring harness Socket	Test box -V.A.G 1598/30- Socket
2	4/24
4	4/31

Resistance: max. 1.5 ohms ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

– Eliminate open circuit in wiring or short circuit if necessary.

If no open circuit is found in wiring:

– Replace brake light switch/brake pedal switch.

1.40 Checking crash signal

In the event of an accident (crash) resulting in belt tensioner/air-bag triggering, the engine control unit deactivates the fuel pump relay, thus preventing excessive fuel spillage in the event of fuel system damage.

As long as the fault “Crash deactivation triggered” is stored in the engine control unit or has not been erased, fuel pump supply is disabled with ignition ON (no generation of supply pressure in fuel system). This may result in delayed starting of the engine.

– Connect test box -V.A.G 1598/30- to wiring harness to diesel direct injection system control unit -J248- ⇒ page 68 .

Check the following wiring for short to positive or earth and open circuit.

Test box - V.A.G 1598/30- Socket	Airbag control unit Contact
4/33	. ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

Resistance: max. 1.5 ohms

– Eliminate open circuit in wiring or short circuit if necessary.

If no fault is found in wiring: Interrogate fault memory of airbag control unit.

1.41 Checking air conditioner compressor shut-off

- ♦ On powerful acceleration from low speed (detection by way of change in angle at accelerator pedal position sender and vehicle speed signal)
- ♦ In emergency running mode (limp-home)
- ♦ If coolant temperature rises above 120 °C
- ♦ For approx. 6 seconds after every starting operation
- • Air conditioner OK
- • Air conditioner switched on
- • No fault stored in fault memory

– Connect fault reader and use “address word” 01 to select diesel direct injection system control unit -J248- . The engine must be idling when doing so.

– Read measured value block “Function 08” display group 02.

Specification: 0 0 0 0 1 0 0 0 (no air conditioner compressor signal)

– Check display in zone 3.

– To do so, switch on air conditioner by pressing “Auto” button.

– Select lowest temperature and highest blower speed. The air conditioner compressor must run.

Specification: 0 0 0 01 0 0 1 (air conditioner compressor signal)

If reading does not match specification:

– Connect test box -V.A.G 1598/30- to wiring harness to diesel direct injection system control unit -J248- ⇒ page 68 .

Check the following wiring for short to positive or earth and open circuit.

Test box - V.A.G 1598/30- Socket	Air conditioner operating and display unit Contact
29	⇒ Current flow diagrams, Electrical fault finding and Fitting locations

Resistance: max. 1.5 ohms

– Eliminate open circuit in wiring or short circuit if necessary.

1.42 Checking air conditioner signal

The air conditioner signal informs the engine control unit that the air conditioner requires a higher idling speed to provide the desired passenger compartment temperature (both when cooling and heating).

Note

The increase in idling speed resulting from the air conditioner signal depends on the control unit version and is not activated in all vehicles.

– Connect fault reader and use “address word” 01 to select diesel direct injection system control unit -J248- . The engine must be idling when doing so.
– Read measured value block “Function 08” display group 02.
– Observe display in zone 3. The air conditioner must not be switched on.

Indicated on display:

– To do so, switch on air conditioner by pressing “Auto” button.
– Select lowest temperature and highest blower speed. The air conditioner compressor must run.
– Check display in zone 3.

Specification: 0 1 0 0 1 0 0 1 (air conditioner signal)

If reading does not match specification:

– Connect test box -V.A.G 1598/30- to wiring harness to diesel direct injection system control unit -J248- ⇒ page 68 .

Check the following wiring for short to positive or earth and open circuit.

Test box - V.A.G 1598/30- Socket	Air conditioner operating and display unit Contact
4/39	. ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

Resistance: max. 1.5 ohms

– Eliminate open circuit in wiring or short circuit if necessary.

1.43 Checking vehicle speed signal

The vehicle speed signal is required for air conditioner compressor shut-off on acceleration, for the cruise control system and to enhance ride comfort (surge damping).

• Speedometer OK, checking ⇒ Rep. Gr. 90

WARNING

Attach fault reader to rear seat and operate from this position. Always observe the relevant safety precautions ⇒ page 47 .

– Connect fault reader and use “address word” 01 to select engine control unit for engine electronics 1 -J248- . The engine must be idling when doing so.
– Read measured value block “Function 08” display group 06.

– Perform test drive.

– Observe display in zone 1.

Specification: The current vehicle speed must be displayed (compare to speedometer).

If reading does not match specification:

– Connect test box -V.A.G 1598/30- to wiring harness to diesel direct injection system control unit -J248- ⇒ page 68 .

Check the following wiring for short to positive or earth and open circuit.

Test box - V.A.G 1598/30- Socket	Dash panel insert Contact
4/22	. ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

Resistance: max. 1.5 ohms

– Eliminate open circuit in wiring or short circuit if necessary.

If no fault is found in wire:

– Determine all “users” of vehicle speed signal (e.g radio, automatic gearbox, air conditioner), consecutively disconnect these from dash panel insert and repeat test until cause has been established.

1.44 Checking engine speed signal

The engine speed signal is required for the rev counter, air conditioner and automatic gearbox.

The signal shape generated by the engine speed sender -G28- cannot however be evaluated and is therefore conditioned beforehand in the engine control unit.

Determine engine speed signal as follows:

Dash panel insert

– Observe rev counter display.

Specification: Current engine speed must be displayed.

Air conditioner

The signal is monitored by the air conditioner self-diagnosis (fault memory, reading measured value block).

Checking signal ⇒ Air conditioning system; Rep. Gr. 01 .

Specification: Current engine speed must be displayed in measured value block.

Automatic gearbox

The signal is monitored by the self-diagnosis (fault memory, reading measured value block) of the automatic gearbox control unit.

Checking signal ⇒ Automatic gearbox; Rep. Gr. 01

Specification: Current engine speed must be displayed in measured value block.

Possible faults if reading does not match specification for all engine speed signal “users”:

♦ Open circuit or short circuit between diesel direct injection system control unit and connector in wiring harness ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

- Short circuit between connector in wiring harness and “user”
- Diesel direct injection system control unit defective

Possible faults if reading does not match specification for at least one engine speed signal “user”:

- Open circuit between connector in wiring harness and “user”
- “User” defective

1.45 Checking data exchange between diesel direct injection system control unit -J248- and diesel direct injection system control unit 2 -J494-

Note

- *Data are exchanged between the individual control units by means of a bus system.*
- *The term “CAN bus” refers to a system for transferring and distributing data.*
- *The diesel direct injection system control unit -J248- informs diesel direct injection system control unit 2 -J494- of the functions to be performed.*

If a fault entry “Engine/engine data bus, no message from engine control unit 1 or 2” has been stored, check wiring connections.

Checking wiring

Note

This CAN bus test requires the use of two test boxes - V.A.G 1598/30- in order to be able to check the wiring of both control units.

– Connect first test box -V.A.G 1598/30- to wiring harness to diesel direct injection system control unit -J248- ⇒ page 68 .
– Connect second test box -V.A.G 1598/30- to wiring harness to diesel direct injection system control unit 2 -J494- ⇒ page 68 .

Check the following wiring for short to positive or earth and open circuit.

Test box -V.A.G 1598/30- , socket (engine control unit 1)	Test box -V.A.G 1598/30- , socket (engine control unit 2)
3/44	3/44
3/45	3/45

Resistance: max. 1.5 ohms

– Eliminate open circuit in wiring/short circuit if necessary. ⇒ Current flow diagrams, Electrical fault finding and Fitting locations
– Check wires (bus wires) for mutual short circuit.

Test box -V.A.G 1598/30- Socket (engine control unit 1)	Test box -V.A.G 1598/30- Socket (engine control unit 2)
3/44	3/45
3/45	3/44

Specification: There must not be any connection between the wires (infinity ohms)

– If no fault is found in the wiring (bus wires), replace diesel direct injection system control unit -J248- in the event of fault code 18317 and diesel direct injection system control unit 2 -J494- in the event of fault code 18318.

1.46 Checking data exchange (CAN bus) between the connected control units

Note

- ♦ *Data are exchanged between the individual control units by means of a bus system.*
- ♦ *The term "CAN bus" refers to a system for transferring and distributing data.*
- ♦ *The wires between the control units on which data are transmitted are referred to as signal wires.*
- ♦ *Data are transmitted serially along these signal wires to the connected control units (e.g. engine speed, accelerator pedal position).*

Checking bus system

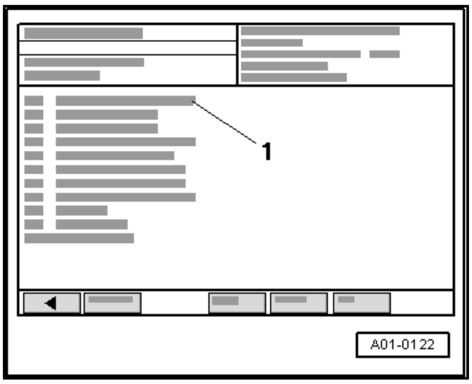
If the fault table indicates the need for checking data exchange between engine control unit, gearbox control unit, ABS control unit, dash panel insert and air conditioner:

– Check for firm attachment of multi-pin connectors of control units.

– Connect fault reader and select engine electronics control unit with "address word" 01. The engine must be idling when doing so.

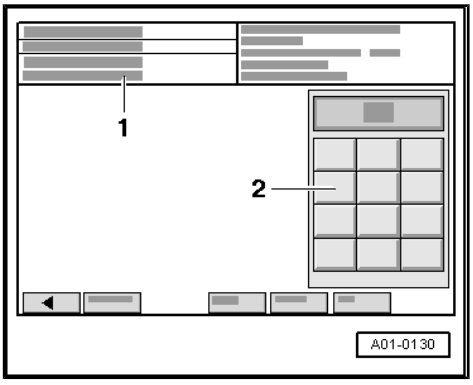
Display on -VAS 5051- :

– From list -1-, select diagnosis function "08 - Reading measured value block".



Display on -VAS 5051- :

1 - Enter display group (highest possible entry = 255)

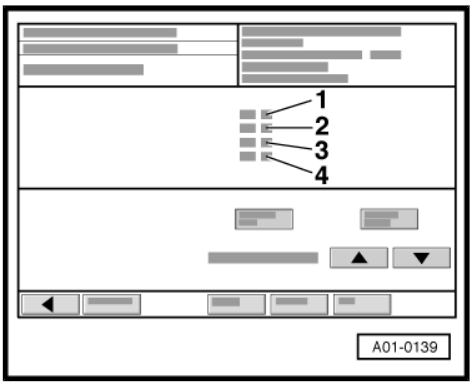


Note

Measured value blocks 125 and 126 indicate drive system data bus users.

– Use keypad -2- to enter “125” for “Display group number 125” and confirm by touching Q key.

Display on -VAS 5051- :



– Check displays in zones -1- to -4-. Display shows control units capable of CAN communication with engine control unit:

♦ No display: Control unit not capable of CAN communication

♦ Display 1: Control unit with CAN capability is data bus user

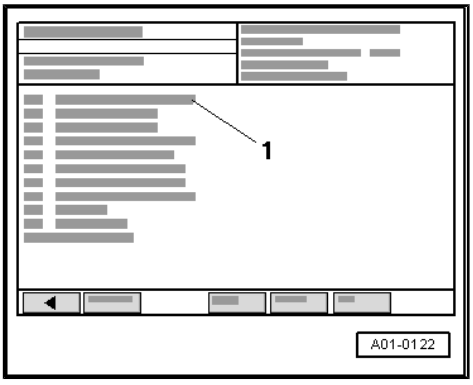
♦ Display 0: Control unit with CAN capability is not data bus user

– Switch to display group 126.

– Perform the same check for display group number 126.

– Terminate function “08 - Reading measured value block” by touching < key.

Display on -VAS 5051- :

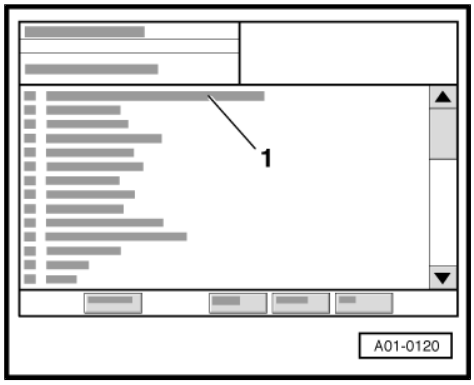


– From list -1-, select diagnosis function “06 - End of output”.

Display on -VAS 5051- :

– From list -1-, select diagnosis function “00 - Interrogating fault memory - Entire system”.

♦ Fault memories of all vehicle systems with self-diagnosis capability are interrogated



If a control unit responds with its identification, the number of stored faults or “No fault detected” appears on the display.

Any stored system faults are consecutively displayed. -VAS 5051- then transmits the next address word.

If a fault relating to “Drive system data bus...” or “...CAN bus” is displayed:

– Check whether vehicle has been fitted with correct engine control unit and other control units with CAN capability (part no. and code).

If the correct control units have been fitted:

– Check for firm attachment of multi-pin connectors of control units.

If multi-pin connectors are properly attached:

– Check CAN bus system.

1.47 Checking “two-wire bus system”

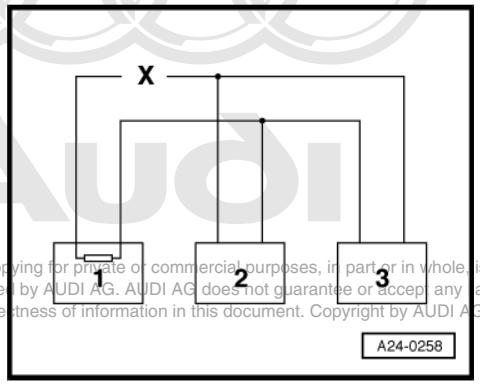
Communication takes place between three or more control units by way of a “two-wire bus system”.

– Assess faults stored in control units.

Assessment helps to localise wiring fault.

Example 1:

The faults entered in the fault memories indicate that there is no connection between control unit 1 and control units 2 and 3.



Control unit	Faults entered in fault memory
1	♦ No message from control unit 2 ♦ No message from control unit 3
2	♦ No message from control unit 1
3	♦ No message from control unit 1

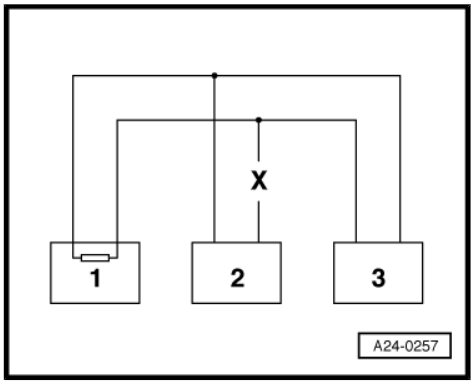
– Switch off ignition.

– Disconnect control units linked by bus wires and check for open circuit in one of the bus wires. ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

– Replace control unit 1 if no faults are found in bus wires.

Example 2:

The faults entered in the fault memories indicate that there is no connection between control unit 2 and control units 1 and 3.



Control unit	Faults entered in fault memory
1	♦ No message from control unit 2
2	♦ No message from control unit 1 ♦ No message from control unit 3
3	♦ No message from control unit 2

– Switch off ignition.

– Disconnect control units linked by bus wires and check for open circuit in one of the bus wires. ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

– Replace control unit 2 if no faults are found in bus wires.

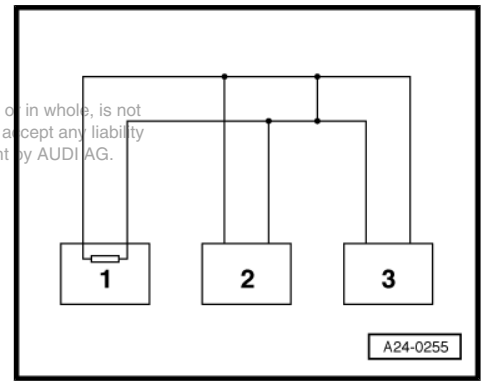
Example 3:

Faults entered in fault memories indicate that none of the control units can transmit or receive.

Control unit	Faults entered in fault memory
1	♦ Drive system data bus defective
2	♦ Drive system data bus defective
3	♦ Drive system data bus defective

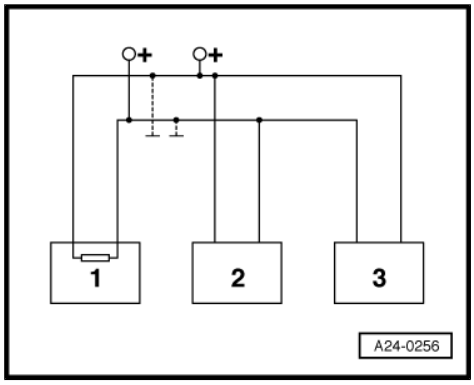
– Switch off ignition.

– Disconnect control units linked by bus wires and check for mutual short circuit in bus wires. ⇒ Current flow diagrams, Electrical fault finding and Fitting locations



– Check bus wires for short to positive and earth.

If the cause of the fault “Drive system data bus defective” cannot be found in the bus wires, check whether one of the control units is responsible for the fault.



Note

Vehicle diagnostic, testing and information system connected and vehicle self-diagnosis selected

All control units using CAN bus for communication still disconnected; ignition switched off

– Connect one of the control units.
– Switch on ignition.

Display on -VAS 5051- :

– From list -1- select appropriate vehicle system.
– Interrogate and erase fault memory of control unit just connected.
– Touch < key.
– From list -1-, select diagnosis function “06 - End of output”.
– Switch ignition off and then on again.
– Leave ignition switched on for 10 seconds. Then use fault reader to read out fault memory of control unit just connected.
– If fault “Drive system data bus defective” is read out, replace control unit just connected.
– If fault “Drive system data bus defective” is not read out, connect next control unit and repeat procedure.

28 – Glow plug system

1 Checking glow plug system

1.1 Checking operation

– Unplug connectors from glow plugs.

– Connect multimeter (voltage measuring range) to one glow plug connector and engine earth.

– Start final control diagnosis and actuate glow plug relay ⇒ page 19 .

Specification: approx. battery voltage (every 5 seconds)

If reading does not match specification:

– Eliminate open circuit in wiring or short circuit if necessary.
⇒ Current flow diagrams, Electrical fault finding and Fitting locations

1.2 Checking glow plugs

• Battery voltage at least 11.5 V

– Switch off ignition.

– Unplug connectors from glow plugs.

– Connect diode test lamp wire with clips from -V.A.G 1594C;Messhilfsmittel-Set- to battery positive (+).

– Consecutively apply test prod of diode test lamp to each glow plug.

Diode lights: Glow plug OK

Diode does not light: Replace glow plug

– Use jointed spanner 3220 to remove and install glow plugs.

Tightening torque: 15 Nm